Altair® 5X MultiGas Detector and Altair® 5X IR MultiGas Detector

Instruction Manual

Altair® 5X Detector MultiGas y Altair® 5X IR Detector MultiGas

Manual de Instrucciones

Altair® 5X Détecteur Multigaz et Altair® 5X IR Détecteur Multigaz

Mode d'emploi

In North America, to contact your nearest stocking location, dial toll-free 1-800-MSA-2222 To contact MSA International, dial 1-724-776-8626 or 1-800-MSA-7777.

This manual is available on the internet at www.msaSafety.com.

Para comunicarse con su distribuidor más cercano en Norteamérica, llame gratis al 1-800-MSA-2222. Para comunicarse a MSA International, marque el 1-724-776-8626 ó 1-800-MSA-7777.

Este manual está disponible en Internet: www.msaSafety.com.

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Ce manuel est disponible sur l'Internet à www.msaSafety.com.

Manufactured by / Fabricado por / Fabriqué par

MSA CORPORATE CENTER

1000 Cranberry Woods Drive,
Cranberry Township, Pennsylvania 16066

(L) Rev 3 **10114801**

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⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this instrument will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

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1 Instrument Safety

1.1 Correct Use

The ALTAIR 5X and ALTAIR 5X IR MultiGas Detectors are:

- for use by trained and qualified personnel
- designed to be used when performing a hazard assessment to:
  - assess potential worker exposure to combustible and toxic gases and vapors as well as low level of oxygen
  - determine the appropriate gas and vapor monitoring needed for a workplace.

The ALTAIR 5X Detector can be equipped to detect:

- combustible gases and certain combustible vapors
- oxygen-deficient or oxygen-rich atmospheres
- specific toxic gases for which a sensor is installed.

While the instrument can detect up to 30% oxygen in ambient air, it is approved for use only up to 21% oxygen.

The ALTAIR 5X IR Gas Detector can also contain one Infrared sensor to detect CO_2 or specific combustible gases up to 100% Vol.

⚠ WARNING

Read and follow all instructions carefully.

- **Perform a blocked flow test before each day's use.**
- **Perform a Bump Test before each day's use, and adjust if necessary.**
- **Perform a Bump Test more frequently if exposed to silicone, silicates, lead-containing compounds, hydrogen sulfide, or high contaminant levels.**
- **Recheck calibration if unit is subjected to physical shock.**
- **Use only to detect gases/vapors for which a sensor is installed.**
- **Do not use to detect combustible dusts or mists.**
- **For accurate catalytic combustible readings, make sure adequate oxygen is present (>10% O_2).**

- **Never block pump inlet, except to perform a sampling system safety test.**
- **Have a trained and qualified person interpret instrument readings.**
- **Risk of Explosion: Do not remove battery pack, recharge Li Ion battery, or replace alkaline batteries in a hazardous location.**
- **Do not alter or modify instrument.**
- **Use only MSA-approved sampling lines.**
- **Do not use silicone tubing or sampling lines.**
- **Wait sufficient time for the reading; response times vary based on gas and length of sampling line.**
- **Do not use the instrument for prolonged periods in an atmosphere containing a concentration of fuel or solvent vapors that may be greater than 10% LEL.**

INCORRECT USE CAN CAUSE DEATH OR SERIOUS PERSONAL INJURY.

This Class A digital apparatus complies with Canadian ICES-003.

1.2 Safety and Precautionary Measures

⚠ WARNING

Carefully review the following safety limitations and precautions before placing this instrument in service. Incorrect use can cause death or serious personal injury.

- Check function (see section 3.6) each day before use. MSA recommends carrying out a routine inspection prior to each day's use.
- Perform a Bump Test (see section 3.7) before each day's use to verify proper instrument operation. The instrument must pass the bump test. If it fails the test, perform a calibration (see section 3.8) before using the instrument.
- The ALTAIR 5X MultiGas Detectors are designed to detect gases and vapors in air only.
- Perform a Bump Test more frequently if unit is subjected to physical shock or high levels of contaminants. Also, perform a Bump Test more frequently if the tested atmosphere contains the following materials, which may desensitize the combustible gas

sensor and reduce its readings:

  - Organic silicones
  - Silicates
  - Lead-containing compounds
  - Sulphur compound exposures over 200 ppm or exposures over 50 ppm for one minute.

- The minimum concentration of a combustible gas in air that can ignite is defined as the Lower Explosive Limit (LEL). A combustible gas reading of "**XXX**" indicates the atmosphere is above 100 % LEL or 5.00 %vol CH4, and an explosion hazard exists. Move away from hazardous area immediately.
- Do not use the ALTAIR 5X, or ALTAIR 5X IR MultiGas Detectors to test for combustible or toxic gases in the following atmospheres as this may result in erroneous readings:
  - Oxygen-deficient or oxygen-rich atmospheres
  - Reducing atmospheres
  - Furnace stacks
  - Inert environments (only IR sensors acceptable for use)
  - Atmospheres containing combustible airborne mists/dusts.
- Do not use the ALTAIR 5X or ALTAIR 5X IR MultiGas Detectors to test for combustible gases in atmospheres containing vapors from liquids with a high flash point (above 38 °C, 100°F) as this may result in erroneously low readings.
- Allow sufficient time for unit to display the accurate reading. Response times vary based on the type of sensor used (see Section 5.3, "Sensor Performance Specifications"). Allow a minimum of 1 second per foot
(3 seconds per meter) of sample line for the sample to be drawn through the sensors.
- Sampling lines made from 0.062 inch (1.57 mm) inner diameter tubing provide fast transport times to the instrument; however, they must be limited to 50 feet (15 m) in length.
- Sampling of reactive toxic gases (Cl_2, ClO_2, NH_3) must only be done with the reactive gas sample line and probe kits listed in the Section 6.2 Accessories table.
- All instrument readings and information must be interpreted by someone trained and qualified in interpreting instrument readings in relation to the specific environment, industrial practice and exposure limitations.

Observe proper battery maintenance

Use only battery chargers made available by MSA for use with this instrument; other chargers may damage the battery pack and the instrument. Dispose of in accordance with local health and safety regulations.

Be aware of environmental conditions

A number of environmental factors may affect the sensor readings, including changes in pressure, humidity and temperature. Pressure and humidity changes affect the amount of oxygen actually present in the atmosphere.

Be aware of the procedures for handling electrostatically sensitive electronics

The instrument contains electrostatically sensitive components. Do not open or perform maintenance on the unit without using appropriate electrostatic discharge (ESD) protection. The warranty does not cover damage caused by electrostatic discharges.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

⚠ WARNING

This is a class A product in accordance with CISPR 22. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

This Class A digital apparatus complies with Canadian ICES-003.

Be aware of the product regulations

Follow all relevant national regulations applicable in the country of use.

Be aware of the warranty regulations

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and maintained in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or service.

1.3 Warranty

ITEM	WARRANTY PERIOD
Chassis and electronics	Three years*
COMB, O_2, H_2S, CO, SO_2, IR sensors	Three years*
Cl_2, NH_3 sensors	Two years*
ClO_2, HCN, NO_2, PH_3 sensors	One year*
*For extended warranty offerings, contact MSA.	

1.3.1 Warranty

This warranty does not cover filters, fuses, etc. As the battery pack ages, there will be a reduction in useable instrument run time. Certain other accessories not specifically listed here may have different warranty periods. This warranty is valid only if the product is maintained and used in accordance with Seller's instructions and/or recommendations.

The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning this product. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass on to the Purchaser all warranties of manufacturers of such components.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

1.3.2 Exclusive Remedy

It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective.

Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully replace any nonconforming equipment or parts shall not cause the remedy established hereby to fail of its essential purpose.

1.3.3 Exclusion of Consequential Damage

Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of nonoperation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

2 Description

2.1 Instrument Overview

1	LEDs (2 red "Alarm", 1 green "Safe" and 1 yellow "Fault")	7	MSA Link™ Communication Port
2	Horn	8	Pump inlet
3	Display	9	Filter
4	▲ Button	10	Belt Clip (ALTAIR 5X only)
5	⏻ Button (Power)	11	Charging Port
6	▼ Button	12	Charge Status LED

Figure 2-1. Instrument View

The instrument monitors gases in ambient air and in the workplace.

The ALTAIR 5X Detectors are available with a maximum of four sensors, which can display readings for five separate gases (one Two-Tox Sensor provides both CO and H_2S sensing capabilities in a single package).

The ALTAIR 5X IR is available with a maximum of five sensors, which can display readings for six separate gases (one Two-Tox Sensor provides both CO and H_2S sensing capabilities in a single package).

The ALTAIR 5X and ALTAIR 5X IR Detectors are available with a monochrome or color display.

While the instrument can detect up to 30% oxygen in ambient air, it is approved for use only up to 21% oxygen.

The alarm levels for the individual gases are factory-set but can be changed through the instrument Setup menu. These changes can also be made through MSA Link software. Ensure that the latest version of the MSA Link software has been downloaded from MSA's website www.msanet.com. It is recommended that after making changes using MSA Link software, the unit should be turned OFF and ON.

2.2 User Interfaces

Instrument operation is dialog driven from the display with the aid of the three function buttons (see FIGURE 2-1).

2.2.1 Button Definitions

The ALTAIR 5X, and ALTAIR 5X IR units have three buttons for user operation. Each button can function as a "soft key", as defined immediately above the button.

BUTTON	DESCRIPTION
⏻	The ⏻ button is used to turn instrument ON or OFF and to confirm user action selections.
▼	The ▼ button is used to page down through data screens or to decrease the values in Setup mode. This button is also used to initiate a Bump Test for the installed sensors, directly from the MEASURING page. If the user is granted access to the MotionAlert setting feature, this button can be used to activate the InstantAlert™ alarm.
▲	The ▲ button is used to reset peak, STEL TWA and alarms (where possible) or perform calibration in measuring mode. It is also used as page up or to increase the values in Setup mode.

When the ▲ button and the ▼ buttons are pressed and held simultaneously while in normal measure mode, the Setup mode can be entered after the Password is confirmed.

2.2.2 LED Definitions

LED	DESCRIPTION
RED (ALARM)	The Alarm LEDs are visual indications of an alarm condition or any type of error in the instrument
GREEN (SAFE)	The Safe LED flashes once every 15 seconds to notify the user that the instrument is ON and operating under the conditions defined below: • The green SAFE LED is enabled • Combustible reading is 0% LEL or 0% Vol • Oxygen (O_2) reading is 20.8% • Carbon Dioxide (CO_2) reading is ≤ 0.03% • All other sensor readings are 0 ppm • No gas alarms are present (low or high) • Instrument is not in Low Battery warning or alarm • STEL and TWA readings are 0 ppm. This option can be turned OFF through the MSA Link software
YELLOW (FAULT)	The Fault LED activates if any of several fault conditions are detected during instrument operation. This includes: • An instrument memory error • A sensor determined to be missing or inoperative • A pump fault. These faults are also indicated by activation of instrument alarm LEDs, horn, and vibrating alarm

2.2.3 Alarms

The instrument is equipped with multiple alarms for increased user safety:

2.2.3.1 Vibrating Alarm

The instrument vibrates when any alarm condition is active. This can be turned OFF through the SETUP- ALARM OPTIONS menu (Section 3.4.2).

2.2.3.2 Horn

This unit is equipped with an audible alarm. The horn can be turned OFF through the SETUP- ALARM OPTIONS menu (Section 3.4.2).

2.2.3.3 InstantAlert™ Alarm

The InstantAlert exclusive feature allows the user to manually activate an audible alarm to alert those nearby to potentially dangerous situations. Holding the ▼ button for approximately 5 seconds while in Normal Measure Mode activates the InstantAlert alarm. Access to this feature may be restricted. See Section 3.4.2 for means to allow/disallow user access.

2.2.3.4 MotionAlert™ Alarm

If MotionAlert is turned ON (**+** = ON) (see Section 3.4.2), the instrument activates a "Man Down" alarm if motion is not detected within 30 seconds. The Alarm LEDs flash, and the horn activates with an increasing audible frequency. MotionAlert is always turned OFF when the instrument is turned OFF. It must always be turned ON prior to use. Access to this feature may be restricted. See Section 3.4.2 for means to allow/disallow user access.

2.2.3.5 Stealth Mode

Stealth Mode disables the visual, audible and vibrating alarms. MSA recommends that this feature be left in its default "OFF" state. Stealth mode can be turned ON through the SETUP - INSTRUMENT OPTIONS menu (Section 3.4.3).

The message "Alarms OFF" flashes on the monochrome display when Stealth mode is ON. On the color display, all three alarm icons are shown as OFF ()

2.2.3.6 Sensor Life Alarm

The ALTAIR 5X Detector evaluates the condition of the sensors during Calibration.

As the end of a sensor's life approaches, a warning is provided. While the sensor is still fully functional, the warning gives the user time to plan for a replacement sensor to minimize downtime. The Sensor Life indicator ♥ displays during ongoing operations as a reminder of a sensor's pending end of life.

When a sensor's end-of-life is reached, sensor calibration will not be successful, and the user is then alerted by a Sensor Life Alarm. A flashing Sensor Life indicator ♥ displays during ongoing operations until the sensor is replaced and/or successfully calibrated.

On the monochrome display, the Sensor Life indicator appears on the display at the same position as the MotionAlert indicator. If MotionAlert is enabled (the **+** indicator displays) and a Sensor Life warning or alarm occurs, the Sensor Life indicator ♥ takes priority and is shown instead.

On the color display, each displayed gas has its own Sensor Life indicator. If a sensor is in end-of-life warning, its indicator is an orange ♥. If a sensor reaches end-of-life, it is in alarm and its Sensor Life indicator is a continuous blinking red ♥.

See "Calibration" (Section 3.8) for additional details on Sensor Life determination and indication.

2.2.4 Backlight

The backlight automatically activates when any front panel button is pressed and remains ON for the duration of user-selected timeout. This duration can be changed using the SETUP - INSTRUMENT MODE (Section 3.4.3) or through MSA Link software.

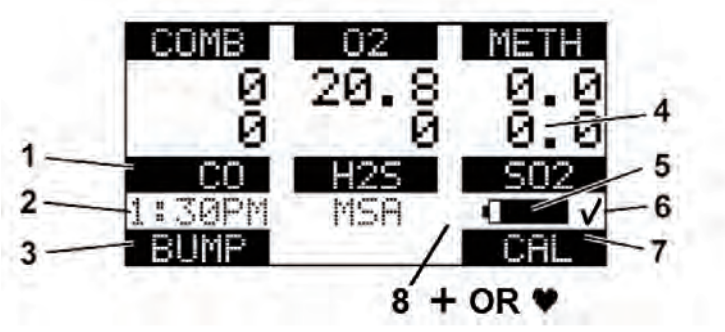
2.2.5 Operating Beep

The Operating Beep activates every 30 seconds by momentarily beeping the horn and flashing the alarm LEDs under the following conditions:

- Operating Beep is enabled
- Instrument is on NORMAL MEASURE GASES page
- Instrument is not in battery warning
- Instrument is not in gas alarm.

2.3 On-Screen Indicators

2.3.1 Monochrome Display

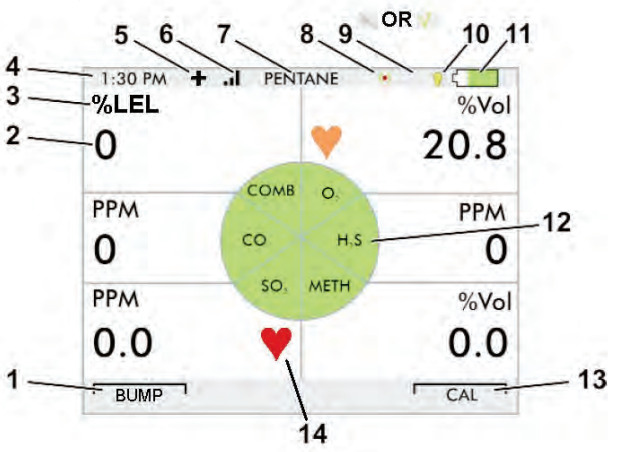


1 Gas Type
2 Current Time
3 "Soft Key" ▼ Indicator
4 Gas Reading
5 Battery Condition
6 Successful Bump Test/Calibration Indicator
7 "Soft Key" ▲ Indicator
8 + MotionAlert (+ = ON))
♥ Sensor Life Indicator

Figure 2-2. Monochrome Display

On a monochrome display, a message appears every 30 seconds if the Vibration, Horn or LED alarms are turned OFF.

2.3.2 Color Display



1		"Soft Key" ▼ Indicator	8		Vibration Alarm OFF
2		Gas Reading	9		Horn OFF or successful Bump Test/Calibration Indicator
3		Gas Concentration Units			
4		Current Time	10		LED OFF
5	+	MotionAlert (+ = ON)	11		Battery Condition
6		Wireless ON	12		Gas Type
7		Combustible Gas type calibration	13		"Soft Key" ▲ Indicator
			14	♥	Sensor Life Indicator

Figure 2-3. Color Display

2.3.3 Battery Indicator

The battery icon continuously displays in the upper right-hand corner of the color display and in the lower right-hand corner of the monochrome display. A bar represents the charge level of the battery.

The nominal run-time of the instrument (COMB, O_2, H_2S, CO, with pump and monochrome display) at room temperature is 17 hours. Actual run-time varies, depending on ambient temperature, battery, and alarm conditions.

2.3.3.1 Low Battery Warning

⚠ WARNING

If battery warning alarm activates while using the instrument, leave the area immediately as the end of battery life is approaching. Failure to follow this warning can result in serious personal injury or death.

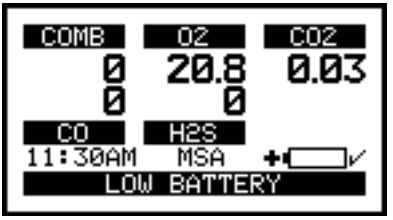


Figure 2-4. Battery Warning

The duration of remaining instrument operation during the low battery warning depends on ambient temperatures, battery condition and alarm status.

When the instrument goes into battery warning the:

- battery life indicator continuously flashes
- alarm sounds and alarm LEDs flash every 30 seconds
- Safe LED no longer flashes
- instrument continues to operate until it is turned OFF or battery shutdown occurs

2.3.3.2 Battery Shutdown

⚠ WARNING

If Battery Alarm displays, stop using the instrument as it no longer has enough power to indicate potential hazards, and persons relying on this product for their safety could sustain serious personal injury or death.

The instrument goes into battery shutdown mode 60 seconds before final shutdown (when the batteries can no longer operate the instrument):

- "BATTERY ALARM" flashes on the display
- Alarm sounds
- Alarm LEDs flash
- Fault LED is ON
- No other pages can be viewed; after approximately one minute, the instrument automatically turns OFF.

Figure 2-5. Battery Shut Down

When battery shutdown condition occurs:

1. Leave the area immediately.
2. Recharge or replace the battery pack.

2.3.4 Battery Charging

⚠ WARNING

Risk of explosion: Do not recharge the instrument in hazardous area.

Use of any charger, other than the charger supplied with the instrument, may damage or improperly charge the batteries.

- The charger is capable of charging a completely depleted pack in less than six hours in normal, room-temperature environments.

  NOTE: Allow very hot or cold instruments to stabilize for one hour at room temperature before attempting to charge.

- Minimum and maximum ambient temperature to charge the instrument is 10°C (50°F) and 35°C (95°F).
- For best results, charge the instrument at room temperature.

To Charge the Instrument

- Firmly insert the charger connector into the charge port on the back of the instrument.
- An LED in the battery pack is used to indicate the charge status.
  - Red = charging
  - Green = charged
  - Amber = fault
- If a problem is detected during charging (LED turns amber), disconnect the charger momentarily to reset the charge cycle.
- The charger MUST BE DISCONNECTED for the unit to operate.
- The battery pack may be charged separately from the instrument
- During periods of non-use, the charger may remain connected to the instrument/battery pack.

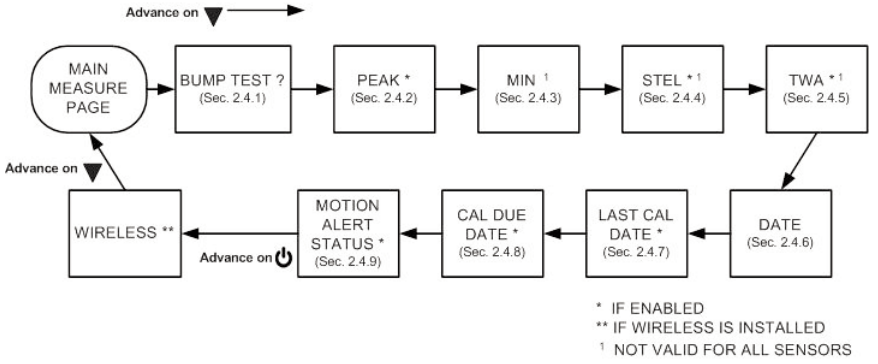
2.4 Viewing Additional Pages

The Main Screen appears at instrument turn-ON.

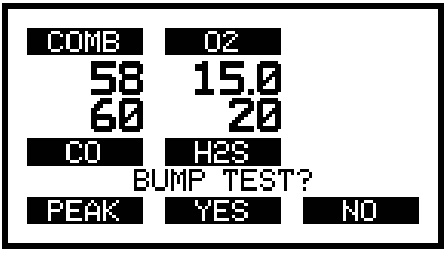
Additional displays can be viewed by pressing the ▼ button to move to the screen as indicated by the "soft key".

(For the monochrome display, the name of the page is displayed; for the color display, it is represented by an icon.)

The sequence of pages are as follows and are described below:



2.4.1 Bump Test (BUMP page)



This page allows the user to perform an automated Bump Test on the instrument. To perform the test, the ⏻ (YES) button is pressed.
See Section 3.7 for details on performing the Bump Test.

If the ▼ button is pressed, the Bump Test is not performed, and the display shows the next page in the sequence (PEAK).

If the ▲ button is pressed, the Bump Test is not performed, and the display reverts back to the normal MEASURE page.

2.4.2 Peak Readings (PEAK page)

MONOCHROME DISPLAY	COLOR DISPLAY
PEAK	

This page shows the highest levels of gas recorded by the instrument since turn-ON or since peak readings were reset.

To reset the peak readings:

1. Access the PEAK page.
2. Press the ▲ button.

This page can be de-activated through MSA Link software.

2.4.3 Minimum Readings (MIN page)

MONOCHROME DISPLAY	COLOR DISPLAY
MIN	

This page shows the lowest level of oxygen recorded by the instrument since turn-ON or since the MIN reading was reset. It is only shown if an oxygen sensor is installed and enabled.

To reset the MIN reading:

1. Access the MIN page.
2. Press the ▲ button.

2.4.4 Short Term Exposure Limits (STEL page)

⚠ WARNING

If the STEL alarm activates, leave the contaminated area immediately; the ambient gas concentration has reached the preset STEL alarm level. Failure to follow this warning will cause over-exposure to toxic gases and persons relying on this product for their safety could sustain serious personal injury or death.

MONOCHROME DISPLAY	COLOR DISPLAY
STEL	

This page shows the average exposure over a running 15-minute period.

When the amount of gas detected by instrument is greater than the STEL limit:

- Alarm sounds
- Alarm LEDs flash
- “STEL ALARM” message flashes.

To reset the STEL:

1. Access the STEL page.
2. Press the ▲ button.

The STEL alarm is calculated over a 15-minute exposure.

STEL calculation examples:

Assume the instrument has been running for at least 15 minutes:

- **15-minute exposure of 35 ppm:**

$$\frac{(15 \text{ minutes} \times 35 \text{ PPM})}{15 \text{ minutes}} = 35 \text{ PPM}$$

- **10-minute exposure of 35 ppm and 5 minute-exposure of 15 ppm:**

$$\frac{(10 \text{ minutes} \times 35 \text{ PPM}) + (5 \text{ minutes} \times 15 \text{ PPM})}{15 \text{ minutes}} = 25 \text{ PPM}$$

This page can be de-activated through MSA Link software.

2.4.5 Time Weighted Average (TWA Page)

⚠ WARNING

If the TWA alarm activates, leave the contaminated area immediately; the ambient gas concentration has reached the preset TWA alarm level. Failure to follow this warning will cause over-exposure to toxic gases and persons relying on this product for their safety could sustain serious personal injury or death.

This page shows the average exposure over 8 hours since the instrument was turned ON or the TWA reading was reset. When the amount of gas detected by the instrument is greater than the TWA limit:

MONOCHROME DISPLAY	COLOR DISPLAY
TWA	

- Alarm sounds
- Alarm lights flash
- "TWA ALARM" message flashes.

To Reset the TWA Readings

1. Access the TWA page.
2. Press the ▲ button.

The TWA alarm is calculated over an eight-hour exposure.

TWA Calculation Examples:

- **1-hour exposure of 50 ppm:**

$$\frac{(1 \text{ hour} \times 50 \text{ PPM}) + (7 \text{ hours} \times 0 \text{ PPM})}{8 \text{ hours}} = 6.25 \text{ PPM}$$

- **4-hour exposure of 50 ppm and 4-hour exposure of 100 ppm:**

$$\frac{(4 \text{ hours} \times 50 \text{ PPM}) + (4 \text{ hours} \times 100 \text{ PPM})}{8 \text{ hours}} = 75 \text{ PPM}$$

- **12-hour exposure of 100 ppm:**

$$\frac{(12 \text{ hours} \times 100 \text{ PPM})}{8 \text{ hours}} = 150 \text{ PPM}$$

This page can be de-activated through MSA Link software.

2.4.6 Date Display

Current date appears on the display in the format: MMM-DD-YY.

2.4.7 LAST CAL Page

Displays the instrument's last successful calibration date in the format: MMM-DD-YY. This page can be de-activated through MSA Link software or the SETUP - CAL OPTIONS page.

2.4.8 CAL DUE Page

Displays the days until the instrument's next calibration is due (user selectable). This page can be de-activated through MSA Link software or the SETUP - CAL OPTIONS page.

2.4.9 MOTIONALERT ACTIVATION Page

When the MotionAlert feature is active, the **+** symbol appears. The instrument enters pre-alarm when no motion is detected for 20 seconds. This condition can be cleared by moving the instrument.
MotionAlert is turned OFF each time the unit is powered OFF.

After 30 seconds of no motion, the full MotionAlert alarm is triggered. This alarm can only be cleared by pressing the ▲ button. This page displays if it was selected in Setup Mode.

To activate or deactivate the MotionAlert feature, press the ▲ button while the MOTIONALERT ACTIVATION page is displayed.

2.5 Sensor Missing Alarm

Enabled IR and XCell sensors are continuously monitored for proper function. If, during operation, the IR or an XCell sensor is detected as failed or disconnected, this alarm message appears.

If the IR or an XCell sensor is detected as missing or failed, the following occurs:

- "SENSOR MISSING" flashes on the display.
- The problematic sensor is indicated.
- The alarm sounds and the Fault and Alarm LEDs flash.
- The alarm can be silenced by pressing the ▲ button; no other pages can be viewed.

⚠ WARNING

When this alarm occurs, the instrument is inoperative for measuring gases. The user must exit the hazardous area, the instrument must be powered down, and the sensor situation must be corrected.

2.6 Monitoring Toxic Gases

The instrument can monitor the concentration of toxic gases in ambient air. Which toxic gases are monitored depends on the installed sensors.

The instrument displays the gas concentration in parts per million (PPM) or mg/m^3 on the MEASURING page.

⚠ WARNING

If an alarm activates while using the instrument, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

The instrument has four gas alarms:

- HIGH Alarm
- LOW Alarm
- STEL Alarm
- TWA Alarm

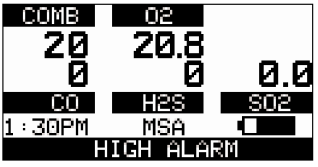


Figure 2-6. Alarm Conditions (High Alarm shown)

If the gas concentration reaches or exceeds the alarm setpoint or the STEL or TWA limits, the:

- alarm message displays and flashes in combination with the corresponding gas concentration:
- backlight turns ON
- alarm sounds (if active)
- alarm LEDs flash (if active)
- vibrating alarm triggers (if active).

2.7 Monitoring Oxygen Concentration

The instrument monitors oxygen concentration in ambient air. The alarm setpoints can be set to activate on two different conditions:

- Enriched - oxygen concentration > 20.8 % or
- Deficient - oxygen concentration < 19.5 %.

While the instrument can detect up to 30% oxygen in the ambient air, it is approved for use only up to 21% oxygen-content.

⚠ WARNING

If an alarm activates while using the instrument, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

When the alarm setpoint is reached for either of the above conditions:

- the alarm message displays and flashes in combination with the oxygen gas concentration
- backlight turns ON
- alarm sounds (if active)
- alarm LEDs flash (if active)
- vibrating alarm triggers (if active).

The LOW alarm (oxygen deficient) is latching and will not reset even when the O_2 concentration rises above the LOW setpoint. To reset the alarm, press the ▲ button. If the alarm is latching, the ▲ button silences the alarm for five seconds. Alarms can be made latching or unlatching via MSA Link software.

False oxygen alarms can occur due to changes in barometric pressure (altitude), humidity, or extreme changes in ambient temperature.

It is recommended that an oxygen calibration be performed at the temperature and pressure of use. Be sure that the instrument is in known fresh air before performing a calibration.

2.8.1 Monitoring Combustible Gases

The instrument can be equipped with a catalytic combustible sensor that detects a variety of combustible gases up to 100% LEL and displays the reading as either % LEL or % CH_4. The ALTAIR 5X IR can also contain an IR combustible sensor. The IR sensor displays the reading in % Vol.

⚠ WARNING

If an alarm activates while using the instrument, leave the area immediately.

Remaining in the area under such circumstances can cause serious personal injury or death.

The catalytic combustible and the 25% Vol Butane IR sensor have two alarm setpoints:

- HIGH Alarm
- LOW Alarm

If the gas concentration reaches or exceeds the alarm setpoint, the instrument:

- alarm message displays and flashes in combination with the corresponding gas concentration:
- backlight turns ON
- alarm sounds (if active)
- alarm LEDs flash (if active)
- vibrating alarm triggers (if active).

The 100% Vol IR sensors have no alarm setpoints.

2.8.2 Gas Exposure of 100% LEL

When the reading from the catalytic combustible sensor reaches 100% of the lower explosive limit (LEL), the instrument enters a LockAlarm™ state and displays "**XXX**" in place of the actual reading.

⚠ WARNING

A catalytic combustible gas reading of "XXX" indicates the atmosphere may be above 100% LEL or 5.00% Vol CH_4 and an explosion hazard exists. Leave the contaminated area immediately.

For ALTAIR 5X IR instruments with an enabled 100% Vol methane IR sensor, the LockAlarm will clear, and the catalytic combustible again displays combustible concentrations when the gas sample drops to a lower level.

For instruments without an enabled 100% Vol methane IR sensor, the user can clear the LockAlarm state only by turning the instrument OFF, and then ON again in a fresh air environment.

When catalytic combustible gas reading digits appear, the instrument is available for measuring gases once again.

NOTE: LockAlarm of the catalytic combustible sensor occurs during Bump Testing and calibration of a % Vol combustible IR sensor. After the IR sensor Bump Test, the LockAlarm must be cleared (as described above) before the catalytic combustible sensor is again able to measure and provide readings.

3 Operation

Instrument operation is dialog driven from the display with the aid of the three Function buttons (see Section 2.2.1).

3.1 Environmental Factors

A number of environmental factors may affect the gas sensor readings, including changes in pressure, humidity and temperature. Pressure and humidity changes affect the amount of oxygen actually present in the atmosphere.

Pressure Changes

If pressure changes rapidly (e.g., stepping through airlock) the oxygen sensor reading may temporarily shift, and possibly cause the detector to go into alarm. While the percentage of oxygen may remain at or near 20.8% Vol, the total amount of oxygen present in the atmosphere available for respiration may become a hazard if the overall pressure is reduced by a significant degree.

Humidity Changes

If humidity changes by any significant degree (e.g., going from a dry, air conditioned environment to outdoor, moisture laden air), oxygen readings can be reduced by up to 0.5% due to water vapor in the air displacing oxygen.

The oxygen sensor has a special filter to reduce the effects of humidity changes on oxygen readings. This effect will not be noticed immediately, but slowly impacts oxygen readings over several hours.

Temperature Changes

The sensors are temperature compensated. However, if temperature shifts dramatically, the sensor's reading may shift temporarily.

3.2 Turning ON

Instrument operation is dialog driven from the display with the aid of the three Function buttons (see Section 2.2.1). For more information, see the flow charts in Section 7.

Turn the instrument ON with the ⏻ button.

- The instrument performs self tests. During the self test, the instrument checks alarm LEDs, audible alarm, vibrating alarm, and installed sensors.
- The instrument displays:
    - Startup logo
    - Software version, instrument serial number, company name, department, and user names
    - Sampling system safety test; see Section 3.2.1

      During the turn-ON sequence, if a sensor was changed since the previous instrument operation, the current listing of the installed sensors displays and user interaction is required.
        - The user must accept the new configuration by pressing the ▲ button.
        - If the current sensor configuration is not accepted, the instrument alarms and is not usable.
    - Combustible gas type, and installed sensor indication
    - Combustible gas type and sensor units (monochrome display only)
    - Low Alarm setpoints
    - High Alarm setpoints
    - STEL Alarm setpoints (if enabled)
    - TWA Alarm setpoints (if enabled)
    - Calibration cylinder settings
    - Current date
    - Last calibration date (if enabled)
    - Calibration due date. If the calibration due date is enabled, the message "**CAL DUE; X DAYS**" appears on the instrument display.
        - X = the number of days until a calibration is due, user selectable for 1 to 180 days.

If the number of days until calibration is due reaches 0, an alert occurs and "**CAL DUE NOW**" displays.

- Press the ▲ button to clear the alert.

- Sensor warm-up period
- Fresh Air Setup option (if enabled).

The Main Measure Page appears.

The presence of a ♥ indicator on the display means a sensor is approaching or has reached its end-of-life. See section 2.2.3.6 for details on the Sensor Life Alarm situation.

See flowchart in Section 7.1

3.2.1 Sampling System Safety Test

At startup, an alarm (visual, audible, and vibrating) is triggered and the customer is prompted to block the pumps/sampling system of the instrument within 30 seconds.

When the instrument detects a pump flow block, it displays a "**PASS**" message. The startup sequence resumes.

If the instrument does not detect a pump flow block, it displays an error message.The instrument shuts OFF after the customer acknowledges this message by pressing the ▲ button. If this occurs check your sampling system and contact MSA as needed.

Users can check the operation of the sampling system anytime during operation by blocking the sampling system to generate a pump alarm.

⚠ WARNING

Do not use the pump, sample line, or probe unless the pump alarm activates when the flow is blocked. Lack of an alarm is an indication that a sample may not be drawn to the sensors, which could cause inaccurate readings.

Failure to follow the above can result in serious personal injury or death.

Never let the end of the sampling line touch or go under any liquid surface. If liquid is drawn into the instrument, readings will be inaccurate and instrument could be damaged. We recommend the use of an MSA sample probe containing a special membrane filter, permeable to gas but impermeable to water, to prevent such an occurrence.

3.2.2 Fresh Air Setup (FAS) at Instrument Turn-ON

The Fresh Air Setup (FAS) is for instrument ZERO adjustment.

The FAS has limits. If a hazardous level of gas is present, the instrument ignores the FAS command and the alarm activates.

The ability to perform an FAS at instrument turn-ON can be disabled by using MSA Link software.

NOTE: The Fresh Air Setup does not apply to the CO_2 sensor.

⚠ WARNING

Do not perform the Fresh Air Setup unless you are certain you are in fresh, uncontaminated air; otherwise, inaccurate readings can occur, which can falsely indicate that a hazardous atmosphere is safe. If you have any doubts as to the quality of the surrounding air, do not use the Fresh Air Setup feature. Do not use the Fresh Air Setup as a substitute for daily calibration checks. The calibration check is required to verify span accuracy. Failure to follow this warning can result in serious personal injury or death.

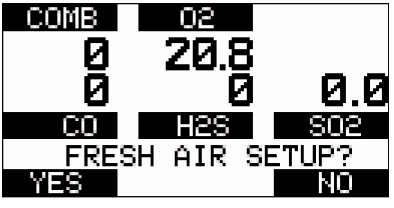


Figure 3-1. Fresh Air Setup

The instrument displays a flashing "FRESH AIR SETUP?", prompting the user to perform a Fresh Air Setup:

1. Press the ▲ button to bypass the Fresh Air Setup.
   - The Fresh Air Setup is skipped
   - The instrument goes to the MEASURING page (MAIN page).
2. Press the ▼ button to perform the Fresh Air Setup.
   - The FAS sequence starts and the FAS screen displays
   - A progress bar shows user how much of the FAS is completed
   - At the end of the FAS, the instrument displays: "**FRESH AIR SETUP PASS**" or "**FRESH AIR SETUP FAIL**".

If the FAS fails, perform a zero calibration per Section 3.8.

3.2.3 Special Consideration for Oxygen Sensor

Under the following situations, the oxygen sensor display reading may be suppressed for up to 30 minutes at instrument turn-ON as a sensor 'cook down' is performed.

This could occur if:

- the oxygen sensor was just installed
- the battery pack was allowed to be deep-discharged
- the battery pack was removed from the instrument.

During this time, the oxygen sensor numeric position on the display indicates "PLEASE WAIT". While this message displays, the instrument cannot respond to a:

- Fresh Air Setup
- Calibration
- Bump Test procedure.

When the numeric oxygen reading appears, the FAS, calibration, or Bump Test procedures may be performed.

3.3 Measurement Mode (Normal Operation)

The following OPTIONS pages can be executed from the Main Measurement screen (for further information see Section 2.4):

BUMP page		allows user to perform a Bump Test on installed sensors; see Section 3.7
PEAK page*	▲	the peak readings for all sensors
MIN page	▼	the minimum reading for the oxygen sensor
STEL page*		the calculated STEL readings of the instrument
TWA page*		the calculated TWA readings of the instrument
DATE page		the date
LAST CAL		the date of the last calibration. If the instrument does not have a valid calibration, it will display "LAST CAL INVALID"
CAL DUE*		the set date for the next calibration
MOTIONALERT	+	if the MotionAlert Feature is activated

* The display of these pages can be de-activated through MSA Link software (Section 2.4)

3.4 Instrument Setup

The instrument allows the user to access and modify the following parameters through direct button interface:

- Calibration Options
- Alarm Options
- Instrument Options.

These menus can be accessed only from the MEASURE page by pressing and holding the ▲ and ▼ buttons simultaneously until prompted for a password.

The operation is as follows:

1. Turn the instrument ON and wait until the MEASURE page appears.
2. Simultaneously press and hold the ▲ and ▼ buttons for approximately five seconds.
   - The default password is "**672**".

Figure 3-2. Password Screen

3. Enter the first digit by pressing the ▲ or ▼ button, and confirm with the ⏻ button.
   - The cursor jumps to the second digit.
4. Enter the second and third digits.
   - Incorrect password: Instrument returns to the MAIN page.
   - Correct password: User can enter the Setup mode.

The password can be changed with a PC through the MSA Link software.

If the password is forgotten, it can be reset by using MSA Link software. Contact MSA Customer Service for assistance.

The following Options are available by pressing the ▲ and ▼ buttons:

- Calibration Options - see Section 3.4.1
- Alarm Options - see Section 3.4.2
- Instrument Options - see Section 3.4.3.

3.4.1 Calibration Options

The Calibration Options menu allows the user to:

- modify the calibration cylinder settings (CYLINDER SETUP)
- enable/disable calibration due date notification and set the number of days (CAL DUE OPTIONS)
    - When enabled, the number of days until instrument calibration is due displays during the turn-ON process.
- enable/disable the option to show the last cal date at turn-ON (LAST CAL DATE)
    - When enabled, the date of the last instrument calibration displays during the turn-ON process.
- enable/disable the option for password-protected calibration (CAL PASSWORD).
    - When enabled, the instrument setup password must be entered prior to calibration.

1. Press the:
    - ▼ button go to next page
    - ▲ button to go previous page
    - ⏻ button to enter setup.

Setting Calibration Cylinder

This option has a dialog similar to the span calibration dialog.

The display shows all active sensors.

1. Press the ⏻ button to enter setup.
    - The screen for the first calibration cylinder displays.
2. Press the:
    - ▼ or ▲ button to change the value.
    - ⏻ button to confirm the setup.

    With this confirmation, the instrument automatically moves to the next cylinder setting.

3. Repeat the sequence for changing the required settings for all necessary gas values.
    - After the last setting is performed, the instrument returns to the Calibration Options menu.

Setting Cal Due Options

1. Press the ⏻ button to enter setup.
2. Press the ▼ or ▲ button to enable/disable this option.
3. Press the ⏻ button to confirm.
4. After confirmation, the instrument prompts the user to enter the number of days for the reminder.
5. Change number of days by pressing the ▼ or ▲ button.
6. Press the ⏻ button to go to the next menu.

Setting Last Cal Date

1. Press the ⏻ button to enable/disable this option.
2. Press the ▼ button to go to the next page.
3. Press the ▲ button to go to the previous page.

Setting Calibration Password

1. Press the ⏻ button to enable/disable this option.
2. Press the to go to the next page.
3. Press the ▲ button to go to the previous page.

Back To Main Menu

1. Press the ⏻ button to go to Instrument Setup menu
    - The Cal Options screen displays
2. Press the ▼ button to go to the next (Alarm options) or the ▲ button to exit the Setup menu.

3.4.2 Alarm Options

Figure 3-4. Alarm Options

The Alarm Options menu allows user to:

- enable/disable the vibrating alarm
- enable/disable the audible alarm (horn)
- enable/disable the Alarm LEDs
- enable/disable the MOTIONALERT SELECTION page.
    - If disabled, the user cannot change the instrument MotionAlert setting.
- set Sensor Alarms.

Press the:

- ▼ button go to next page
- ▲ button to go previous page
- ⏻ button to enter setup.

Setting Vibrating Alarm

- Press the ⏻ button to turn this option ON or OFF.

Setting Horn Alarm

- Press ⏻ button to turn this option ON or OFF.

Setting LED Alarm

- Press the ⏻ button to turn this option ON or OFF.

Setting MotionAlert Access

Setting this parameter allows the user to access the MOTIONALERT page from the MEASURE page.

- If access is denied here:
    - the user cannot access the MOTIONALERT page to enable or disable that feature
    - the InstantAlert feature (Section 2.2.3.3) cannot be activated.

1. To grant or deny user access to the MOTIONALERT page, use the button to change the indicated selection.

User access is:

- permitted when the setting indicates ON.
- denied when the setting indicates OFF.

2. The selection is confirmed by pressing either the ▼ or ▲ button.

Setting Sensor Alarms

This page allows user to modify the preset alarm values for:

- LOW Alarm
- HIGH Alarm
- STEL Alarm
- TWA Alarm.

The factory-set alarm values are shown in Section 5.2.

1. Press the ⏻ button to enter Sensor Alarm setup.
   - LOW Alarm Setup screen displays.

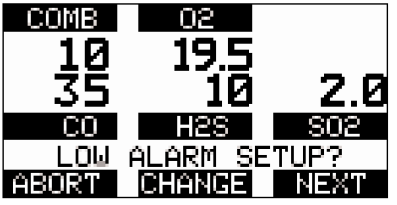


Figure 3-5. Sensor Alarm Setup

2. Press the:
    - ▼ button to abort the operation or
    - ▲ button to go to next alarm setup or
    - ⏻ button to change the alarm setpoints.
        - Alarm Value for the first sensor displays.

Figure 3-6. Sensor Alarm Setup

3. Set values for Sensor Alarm by pressing the▼ or ▲ button.
4. Press the ⏻ button to confirm set value.
5. Repeat setting for all other sensors.
6. Press the ▲ button to return to the Alarm Options menu.
7. Repeat setting for all other alarm types.

3.4.3 Instrument Options

Figure 3-7. Instrument Options

The Instrument Options menu allows the user to modify different instrument options:

- Sensor Setup (enable/disable the channel)
- Language
- Time and Date Set
- Datalog Interval
- Stealth Mode
- Operating Beep
- Display Contrast (monochrome only)
- Backlight Options.

1. Press the:
   - ▼ button to go to next page
   - ▲ button to go previous page
   - ⏻ button to enter setup.

Setting Sensor Options

1. Press the ⏻ button to enter setup.
   - The following screen displays:

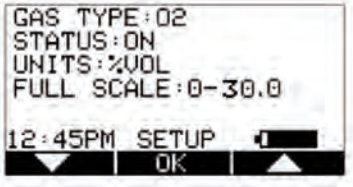


Figure 3-8. Sensor Options

2. Press the ▼ button to select sensor and the ⏻ button to make changes.
   - The sensor information is displayed, and the sensor can be enabled or disabled.

   NOTE: Other operations such as changing the gas type (Methane, Butane, Propane, etc. for the combustible sensor) and units (ppm to mg/m^3) are only possible using the MSA Link software.

3. Change status by pressing the ▼ or ▲ button.
4. Press the ⏻ button to confirm and advance to the next screen (next sensor).
5. Perform the sequence for all other sensors
   - After setting up the last sensor, the instrument goes to the next SETUP page.

Language

This option is for setting the language of the instrument.

1. Press ⏻ button to enter Setup.
2. Change language by pressing the ▼ or ▲ button.
3. Confirm by pressing the ⏻ button.
   - The instrument goes to the next SETUP page.

Time and Date Set

The instrument first prompts the user to set the time; then, it prompts for the date.

NOTE: The time can be set for either regular AM/PM or military time through MSA Link software. AM/PM time is the default setting.

1. Press the ⏻ button to enter setup.
2. Change hours by pressing the ▼ or ▲ button. Increment through noon for PM hours.
3. Confirm by pressing the ⏻ button.
4. Change minutes by pressing the ▼ or ▲ button.
5. Confirm by pressing the ⏻ button.
   - The instrument goes to the SET DATE page.
6. Change month, date, and year by pressing the ▼ or ▲ button:
7. confirming by pressing the ⏻ button.
   - The instrument goes to the next SETUP page.

Setting Datalog Interval

This option is for setting the interval at which all the readings are logged.

1. Press the ⏻ button to enter Setup.
2. Change interval by pressing the ▼ or ▲ button.
3. Confirm by pressing the ⏻ button.
   - The instrument goes to the next SETUP page.

Setting Stealth Mode

Stealth mode disables the visual, audible and vibrating alarms.

1. Press the ⏻ button to change mode (ON/OFF).
2. Press the ▼ button to go to the next page or the ▲ button to return to the previous page.

Setting Operating Beep

1. Press the ⏻ button to change mode (ON/OFF).
2. Press the ▼ button to go to the next page or the ▲ button to return to the previous page.

Setting Display Contrast (monochrome display)

1. Press the ▼ or ▲ button to adjust the contrast level.
2. Press the ⏻ button to confirm the contrast level.

Setting Backlight

1. Press the ⏻ button to enter Setup.
2. Change option by pressing the ▼ or ▲ button.
3. Press the ⏻ button to enter.
4. Change timeout by pressing the ▼ or ▲ button.
5. Press the ⏻ button to confirm timeout.

Back To Main Menu

There are three options at this point; press the:

- ▼ button to go to the Sensor Options menu
- ▲ button to go to the PREVIOUS SETUP page in the Instrument Options menu
- ⏻ button to go to the Instrument Options menu.

3.5. MSA Link Operation

Connecting Instrument to PC

1. Switch ON the ALTAIR 5X Gas Monitor and align the Datalink Communication port on the ALTAIR 5X Monitor to the PC IR interface.
2. Start the MSA Link software on the PC and start the connection by clicking the connect icon.

See MSA Link documentation for detailed instructions.

3.6. Function Tests on the Instrument

Alarm Test

1. Turn ON the instrument. The user should verify that:
   - alarm LEDs flash
   - horn sounds briefly
   - vibrating alarm triggers briefly.

3.7 Bump Test

⚠ WARNING

Perform a Bump Test before each day's use to verify proper instrument operation. Failure to perform this test can result in serious personal injury or death.

This test quickly confirms that the gas sensors are functioning. Perform a full calibration:

- periodically to ensure accuracy
- immediately if the instrument fails the Bump Test.

CSA requires (per 22.2 NO. 152) that instrument sensitivity be tested before each day's use on a known concentration of methane equivalent to 25 to 50% of full scale concentration. ACCURACY MUST BE WITHIN 0 to +20% OF ACTUAL. Correct accuracy by performing the calibration procedure described in Section 3.8.

The Galaxy Test System can also be used to perform a Bump Test.

NOTE: The Galaxy cannot test the following sensors:

- Chlorine Dioxide
- % Vol Butane
- % Vol Propane
- % Vol Methane.

For these sensors, use this Bump Test procedure.

3.7.1 Equipment

See Section 6.2, Accessories Parts List, for information on ordering these components.

- Calibration Check Gas Cylinder(s)
  - See Section 5.4 for calibration gas target values and appropriate MSA calibration gas cylinders.
- Demand Flow Regulator(s)
- Tubing appropriate for the gases to be tested
- Kits containing tubing and regulators suitable for reactive and non-reactive gases are available from MSA.

3.7.2 Performing a Bump Test

For ALTAIR 5X IR units with combustible % Vol IR sensors, the following gas levels should not be exceeded when used for daily

Bump Tests:

- IR Butane 25% Vol - 2% Vol Butane Cal Check gas
- IR Propane 100% Vol - 8% Propane Cal Check gas
- IR Methane 100% Vol - 20% Methane Cal Check gas.

1. While the instrument is turned ON in a clean, fresh air environment, verify that readings indicate no gas is present.
2. From the normal Measure screen, press the ▼ (BUMP) button to display "**BUMP TEST?**".

   Verify that displayed gas concentrations match the Calibration Check Gas Cylinder. If they do not, adjust the values through the Calibration Setup menu as described in Section 3.4.1.

   Depending on the sensors installed, there could be one to five separate Bump Tests performed, each with a different cylinder, regulator, and tubing used.
3. Attach the demand regulator (supplied in the calibration kit) to the cylinder providing the indicated gases.
4. Connect tubing (supplied in the calibration kit) to the regulator.
5. Attach the other end of tubing to the instrument pump inlet.
6. Press the ⏻ button to start the Bump Test:
   - the progress bar advances
   - the sensors respond to the gas.

   The message "**BUMP TEST PASS**" indicates a successful Bump Test of the sensors.

   If any sensor fails the Bump Test:
   - the message "**BUMP TEST FAIL**" appears
   - the failed sensor is indicated.
7. If there are more sensors to be Bump Tested, the next sensor displays and the process repeats from Step 3 in this Section.
8. If there are no more sensors to be Bump Tested, the tubing can be removed from the instrument pump inlet.
9. In the ALTAIR 5X IR, Bump Testing of a combustible IR sensor causes the catalytic combustible sensor to enter the LockAlarm condition. While an instrument with a % Vol methane IR sensor automatically recovers from LockAlarm, % Vol propane or butane instruments do not. For these instruments, clear the LockAlarm state by turning the instrument OFF, then ON while in a fresh air environment. See Section 2.8.2 for additional details.

3.7.3 After the Bump Test

After all installed sensors pass the Bump Test, the √ symbol displays on the MEASURE page. This √ symbol appears on the:

- color display in the upper feature bar
- monochrome display in the lower-right corner.

If any sensor was not Bump Tested, or fails the Bump Test, the √ symbol does not display.

The color display:

- temporarily shows the √ symbol at each gas reading for successfully Bump Tested sensors
- √ symbol is then replaced by the present gas reading.

The monochrome display does not show individual gas reading √ symbols.

The √ symbol on the color display feature bar and the monochrome display lower-right corner shows for 24 hours after the Bump Test.

If a sensor instrument fails the Bump Test, calibrate the instrument as described in Section 3.8.

3.8. Calibration

The ALTAIR 5X instrument can be calibrated either manually by using this procedure or automatically by using the Galaxy Test System. See Section 3.9 for additional Galaxy information.

The use of the demand regulators listed in Section 6.2 is recommended.

⚠ WARNING

Attention! Special conditions with toxic gases!

Reactive toxic gases (chlorine, ammonia, chlorine dioxide) have the property of diffusing into the rubber and plastic tubes so that the volume of test gas available in the instrument would no longer be sufficient to correctly perform instrument calibration.

For this reason, when calibrating the instrument with reactive toxic gases, certain prerequisites are required; otherwise, incorrect calibration could result:

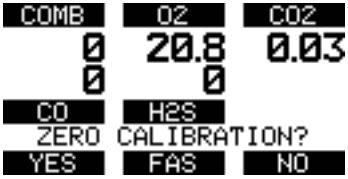
- **A special pressure regulator**
- **The shortest possible connection tubes between the pressure regulator and the instrument.**
- **Connection tubes made from a material that does not absorb the test gases (e.g., PTFE).**

NOTE: If using normal tubes and pressure regulators, expose them to the required test gas for an extended time period. Keep these materials dedicated for use with that test gas only; do not use them for other gases.

For example: for chlorine, allow the entire contents of a test gas cylinder to flow through the pressure regulator and tubes before using to calibrate the instrument. Mark these materials for use with chlorine only.

3.8.1 Zero Calibration

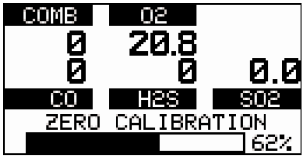
1. Press the ▲ button for five seconds in the NORMAL MEASUREMENT page.
   - ZERO screen displays:



   To skip the ZERO procedure and move directly to the span calibration procedure, push the ▲ button. If no button is pushed for 30 seconds, the instrument prompts the user to perform a SPAN calibration before the instrument returns to the NORMAL MEASUREMENT page.

   To perform ONLY a Fresh Air Setup at this time, press the ⏻ button. The instrument then performs a Fresh Air Setup as described in Section 3.2.2. When the Fresh Air Setup is complete, the instrument returns to the normal Measure screen.

2. Press the ▲ button to confirm the ZERO screen, i.e., to execute zero calibration.

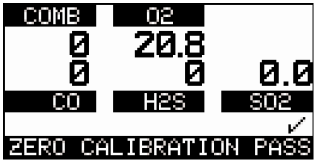


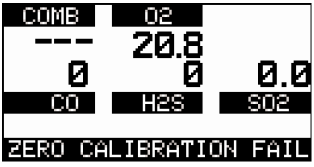
- The message "**SENSOR REFRESH**" displays, followed by the message "**ZERO CALIBRATION**".
  - The "**REFRESH**" message does not appear if a catalytic combustible sensor is not installed.
- ZERO calibration starts
- A progress bar shows the user how much of the calibration is completed.

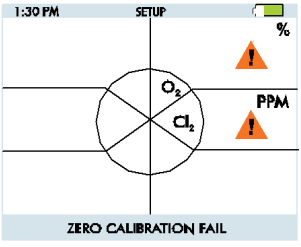
NOTE: During the first moments of a ZERO calibration, the combustible sensor reading may be replaced by a moving display of **"PLEASE WAIT"**. This is normal.

- After the ZERO calibration completes, the instrument displays:
  - "**ZERO CALIBRATION PASS**"

    or
  - "**ZERO CALIBRATION FAIL**".

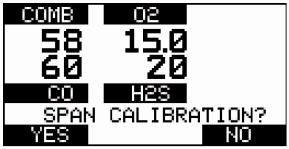






- If the zero calibration passes, the instrument moves to the SPAN calibration opportunity:

3.8.2 Span Calibration



To skip the Span calibration procedure, push the ▲ button.

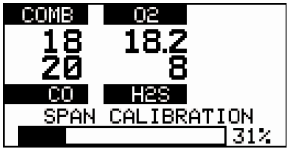
NOTE: If the SPAN calibration of the combustible sensor is skipped after a successful ZERO calibration, the combustible sensor reading may be replaced with a moving display of **"PLEASE WAIT"** for a few moments. This is normal, and the instrument is fully operational once a combustible gas reading reappears.

Span calibration for the indicated sensor(s) is also skipped if neither button is pressed within 30 seconds.

Because of the different combinations of gases that are possible, skipping a Span calibration may advance the user to the Span calibration of another installed sensor, or back to the Measuring mode.

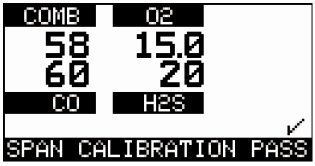
When calibrating with combustible gases > 100% LEL, select the "Yes" option to prompt "**Span Calibration?**" **BEFORE applying gas** to the instrument.

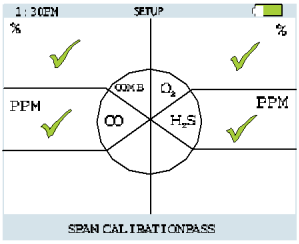
1. Connect one end of tubing to the cylinder regulator (supplied in the calibration kit).
2. Connect the other end of the tubing to the pump inlet.
3. Press the ▼ button to calibrate the span of the instrument.



- "**SPAN CALIBRATION**" flashes
- SPAN calibration starts
- A progress bar shows the user how much of the calibration is completed

- After SPAN calibration is completed, the instrument displays:
  - "**SPAN CALIBRATION PASS**"
    - If a sensor is nearing its end-of-life, this "PASS" display is followed by the Sensor Life indicator ♥ display.
    - While the sensor is still fully functional, this warning gives the user time to plan for a replacement sensor to minimize downtime.
    - The ♥ indicator blinks as the instrument returns to Measure mode.
    - After 15 seconds, the blinking stops, but the ♥ indicator continues to display during ongoing operations as a reminder of a sensor's pending end-of-life.





or

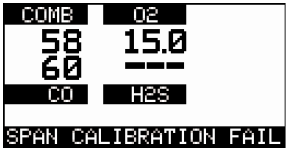
  - "**SPAN CALIBRATION FAIL**"

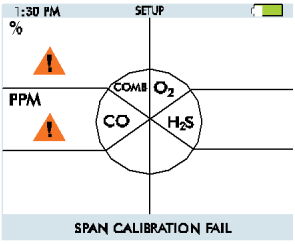
    If a span calibration fails:

    - The Sensor Life Indicator ♥ blinks to show a sensor has reached its end-of-life and should be replaced.
    - The instrument remains in the Sensor Life alarm condition until the ▲ button is pressed.
    - After the alarm is cleared, the instrument enters Measure mode and the Sensor Life indicator ♥ blinks during ongoing operations until the sensor is replaced and/or successfully calibrated.

    Span calibration can fail for reasons other than a sensor at the end of its life. If a span calibration failure occurs, verify items such as:

    - sufficient gas remaining in the calibration cylinder
    - gas expiration date
    - integrity of calibration tubing/fittings, etc.
  - Reattempt the span calibration before replacing the sensor.





3.8.3 Finishing Successful Calibration

Remove the calibration tube from instrument pump inlet.

- The calibration procedure adjusts the span value for sensors that pass calibration.
- In the ALTAIR 5X IR, a combustible IR sensor calibration causes the catalytic combustible sensor to enter the LockAlarm condition.
    - While an instrument with a % Vol methane IR sensor automatically recovers from LockAlarm, % Vol propane and butane instruments do not; for these instruments, the LockAlarm state is cleared by turning the instrument OFF, then ON while in a fresh air environment.
        - See Section 2.8.2 for additional details.
- On the color display, each successfully calibrated sensor temporarily shows a √ symbol at its gas reading.
    - These √ symbols remain visible for a few moments and are then replaced by the present gas reading.
    - The monochrome display does not show individual gas reading √ symbols.
- Since residual gas may be present, the instrument may briefly go into an exposure alarm after the calibration sequence is completed.
    - Clear the alarm as necessary.
- A √ symbol displays on the MEASURE page.
- This √ symbol:
    - appears on the color display in the upper feature bar
    - appears on the monochrome display in the lower right corner
    - remains on the display for 24 hours after the calibration
    - goes OFF after 24 hours.

NOTE: If the horn alarm is turned OFF, the calibration √ symbol does not appear on the color display.

3.9 Calibration with the Galaxy Test System

The instrument can be calibrated using the Galaxy Automated Test System - contact MSA for a list of compatible gases and concentrations.

NOTE: The Galaxy is not a CSA certified method of calibration.

Similar to the successful (manual) calibration described in Section 3.8.3, a √ symbol displays on the MEASURE page after successful Galaxy calibration.

- This √ symbol:
  - appears on the color display in the upper feature bar
  - appears on the monochrome display in the lower right corner
  - remains on the display for 24 hours after the calibration
  - goes OFF after 24 hours.

  NOTE: If the horn alarm is turned OFF, the calibration √ symbol does not appear on the color display.

3.10 Instrument Shutdown

For instrument shutdown, press and hold the ⏻ button.

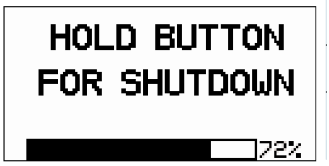


Figure 3-9. Instrument Shutdown

- The instrument:
  - displays a flashing "**HOLD BUTTON FOR SHUTDOWN**"
  - shows a progress bar, informing the user how much longer to hold the button to complete the shutdown.

4. Maintenance

If irregularities occur during operation, use the displayed error codes and messages to determine appropriate next steps.

⚠ WARNING

Repair or alteration of the ALTAIR 5X or ALTAIR 5X IR MultiGas Detectors, beyond the procedures described in this manual or by anyone other than a person authorized by MSA, could cause the instruments to fail to perform properly. Use only genuine MSA replacement parts when performing any maintenance procedures described in this manual. Substitution or incorrect installation of components can seriously impair instrument performance, alter intrinsic safety characteristics, or void agency approvals.

FAILURE TO FOLLOW THIS WARNING CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

4.1 Troubleshooting

PROBLEM	DESCRIPTION	ACTION
ERROR ADC	Analog measurement error	Contact MSA
ERROR MEM	Memory error	Contact MSA
ERROR PROG	Program error	Contact MSA
ERROR RAM	RAM error	Contact MSA
 LOW BATTERY	Battery Warning repeats Every 30 seconds	Remove from service as soon as possible and recharge or replace battery
BATTERY ALARM	Battery completely discharged	Instrument is no longer sensing gas; Remove from service and recharge or replace battery.
Instrument does not turn ON	Battery fully discharged	Remove from service and recharge or replace battery pack
MISSING SENSOR	Sensor damaged or missing	Replace sensor
NO SENSORS	No sensors are enabled	Instrument must have at least one sensor enabled at all times
	Sensor Warning	A sensor is near its end-of-life
 (flashing)	Sensor Alarm	A sensor has reached end-of-life and cannot be calibrated. Replace sensor and recalibrate

4.2 Verifying Pump Operation

Users can check operation of the sampling system any time during operation by blocking the sampling system to generate a pump alarm.

When the pump inlet, sample line or probe is blocked, the pump alarm must activate.

Once gas readings display, plug the free end of sampling line or probe.

- The pump motor shuts down and an alarm sounds.
- "**PUMP ERROR**" flashes on the display.

Press the ▲ button to reset the alarm and restart the pump.

If the alarm does not activate:

1. Check the sample line and probe for leaks.
2. Once leak is fixed, recheck pump alarm by blocking the flow.
3. Press the ▲ button to reset the alarm and restart the pump.

⚠ WARNING

Do not use the pump, sample line, or probe unless the pump alarm activates when the flow is blocked. Lack of an alarm is an indication that a sample may not be drawn to the sensors, which could cause inaccurate readings.

Failure to follow the above can result in serious personal injury or death.

Never let the end of the sampling line touch or go under any liquid surface. If liquid is drawn into the instrument, readings will be inaccurate and instrument could be damaged. We recommend the use of an MSA sample probe containing a special membrane filter, permeable to gas but impermeable to water, to prevent such an occurrence.

During operation, a pump alarm may occur when the:

- Flow system is blocked
- Pump is inoperative
- Sample lines are attached or removed.

To Clear Pump Alarm

1. Correct any flow blockage.
2. Press the ▲ button.
   - The pump will now restart.

4.3 Replacing the Battery

⚠ WARNING

Never replace the battery in a hazardous area.

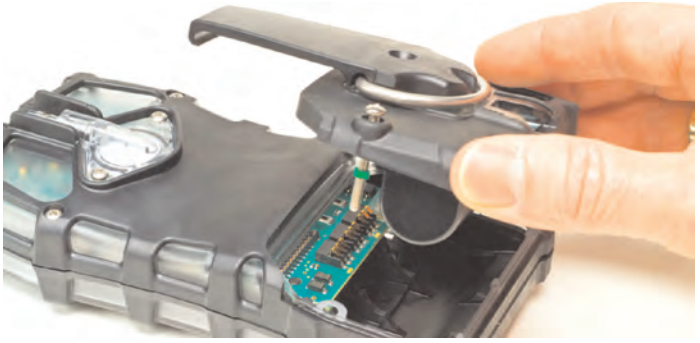


Figure 4-1. Battery Replacement

1. Unscrew the two captive screws on the rear of the instrument.
2. Pull the battery pack out of the instrument by gripping the sides and lifting it up and away from the instrument.

Figure 4-2. Battery Replacement

3. For alkaline battery packs (ALTAIR 5X only):
   a. Remove the battery holder circuit board from the pack door.
   b. Replace the three cells, using only those listed on the label.
      - Be sure to observe proper polarity on the cells.
   c. Place the battery holder circuit board back in the pack door, and reinstall the door into the instrument.
   d. Tighten the two screws.

4.4 Live Maintenance Procedure - Sensor Replacement

The user may remove or replace any factory-installed Series 20 or XCell sensor with a like type.

The user may not change the type of any sensor. If the type of any sensor (including the IR sensor) is to be changed, the instrument must be returned to an authorized service center.

- See FIGURE 4-3 for sensor placement.

⚠ CAUTION

Before handling the PC board, the user must be properly grounded; otherwise, static charges could damage the electronics. Such damage is not covered by the warranty. Grounding straps and kits are available from electronics suppliers.

⚠ WARNING

Remove and reinstall sensors carefully, ensuring that the components are not damaged; otherwise instrument intrinsic safety may be adversely affected, wrong readings could occur, and persons relying on this product for their safety could sustain serious personal injury or death.

⚠ CAUTION

While instrument case is open, do not touch any internal components with metallic/conductive objects or tools. Damage to the instrument can occur.

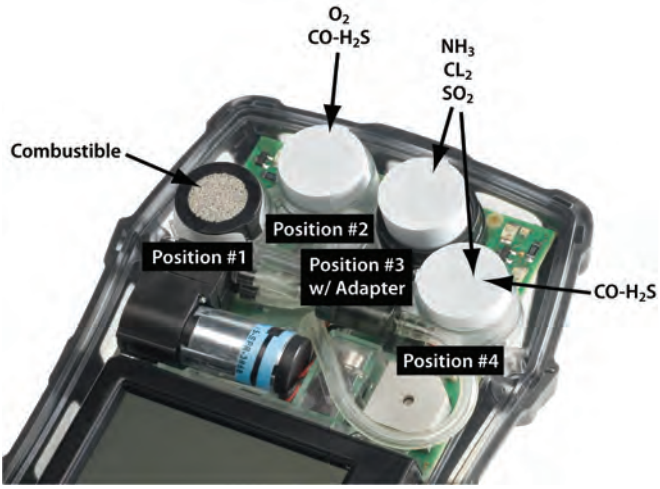


Figure 4-3. Sensor Replacement

1. Verify that the instrument is turned OFF.
2. Remove the battery pack.
3. Remove the two remaining case screws and the case front.
4. Gently remove the sensor to be replaced.
5. Carefully align the new sensor contact pins with the sockets on the printed circuit board; press it firmly in place.

   Note the position restrictions in the following TABLE.

   - Adapter (P/N 10110183) is required for XCell usage in Position #3.
   - ENSURE THAT A SENSOR PLUG IS PROPERLY INSTALLED IN ANY POSITION THAT DOES NOT HAVE A SENSOR.
   - The plug for XCell positions is P/N 10105650. The Series 20 plug is P/N 10088192.

SENSOR	OPERATIONAL ONLY IN
XCell combustible sensor	Position #1
XCell O_2 sensor	Position #2
XCell CO-H_2S Two-tox sensor	Position #2 or #4
XCell SO_2, Cl_2, NH_3	Positions #3 or #4
Series 20 sensor	Position #3

6. Re-install the sensor gasket in the case front.
7. Re-install the front case, screws, and battery pack.
8. If a change in XCell Sensor configuration is detected during the instrument turn-ON process:
   - The "**ACCEPT?**" prompt appears on the display
   - The ▼ (YES) button accepts the sensor configuration
   - The ▲ (NO) button rejects the sensor configuration; the instrument is not operational.
9. When an XCell sensor is replaced, the instrument automatically enables the sensor after the user accepts the change. If a Series 20 sensor is replaced, the user must ensure that the sensor is enabled (see Section 3.4.3).
10. If the oxygen sensor was replaced, see Section 3.2.3 regarding the oxygen reading display.
11. **After installation of new sensors, allow them to stabilize at least 30 minutes before calibration. Calibrate instrument before use.**

⚠ WARNING

Calibration is required after a sensor is installed; otherwise, the instrument will not perform as expected and persons relying on this product for their safety could sustain serious personal injury or death.

4.5. Replacing the Pump Filter

1. Turn OFF the instrument.
2. Unscrew the two captive screws from the clear filter cover on the back of the instrument to access the filter.
3. Carefully lift out the O-ring and the filter disk.
4. If the instrument is NOT configured to use a reactive toxic gas sensor (does not have a Cl_2, ClO_2, or NH_3 sensor), use both the paper-like filter and the fibrous dust filter (the thicker disk) as supplied in Maintenance Kit (P/N 10114949).

   If the instrument IS configured to use a reactive toxic gas sensor (Cl_2, ClO_2, or NH_3), use ONLY the paper filter supplied in the Reactive Gas Maintenance Kit (P/N 10114950).

⚠ CAUTION

Use of the fibrous dust filter or the incorrect paper filter for the measurement of reactive gasses could cause erroneous readings.

Place the new paper-like filter into the recess in the back of the instrument. If it is to be used, place the fibrous dust filter into the clear filter cover.

5. Replace the O-ring in the recess.
6. Re-install the clear filter cover on the back of the instrument.

4.6 Cleaning the Instrument

Clean the exterior of the instrument regularly using only a damp cloth. Do not use cleaning agents as many contain silicones which damage the combustible sensor.

4.7 Storage

When not in use, store the instrument in a safe, dry place between 65°F and 86°F (18 °C and 30 °C). After storage, always recheck instrument calibration before use. If not to be used in 30 days, remove battery pack or connect it to a charger.

4.8. Shipment

Pack the instrument in its original shipping container with suitable padding. If the original container is unavailable, an equivalent container may be substituted.

5. Technical Specifications/Certifications

5.1 Technical Specifications

WEIGHT	1 lb. (0.45 kg) for instrument with battery and clip (ALTAIR 5X unit)
WEIGHT (WITH IR SENSOR)	1.15 lb. (0.52 kg)
DIMENSIONS	6.69" H x 3.49" W x 1.79" D without belt clip (ALTAIR 5X unit)
DIMENSIONS WITH IR SENSOR	6.68" H x 3.52" W x 1.92" D
ALARMS	LEDs, audible alarm, vibrating alarm
ACOUSTIC ALARM VOLUME	95 dB typical
DISPLAYS	Monochrome or color
BATTERY TYPES	Rechargeable Li ION battery Replaceable AA alkaline (ALTAIR 5X unit only)
CHARGING TIME	≤ 6 hours. Maximum safe area charging voltage; Um = 6.7 Volts DC
NORMAL TEMP RANGE	14°F to 104°F (-10°C to 40°C)
EXTENDED TEMP RANGE	-4°F to 122°F (-20°C to 50°C) MONOCHROME DISPLAY 14°F to 122°F (-10°C to 50°C) COLOR DISPLAY - 4°F to 104°F (-20°C to 40°C) for instruments with ClO_2 sensors
SHORT TERM OPERATIONS (15 MINUTES) TEMP RANGE	-40°F to 122°F (-40°C to 50°C)
HUMIDITY RANGE	15 - 90% relative humidity, non-condensing; 5 - 95% RH intermittent
ATMOSPHERIC PRESSURE RANGE	11.6 to 17.4 PSIA (80 to 120 kPA)
DUST & SPRAY PROTECTION	IP 65
MEASURING METHODS	**Combustible gas:** Catalytic or Infrared sensor **O_2 and Toxic gas:** Electrochemical or Infrared sensor
WARRANTY	See Section 1.3

MEASURING RANGE				
	H_2S 0-200 ppm	**CO** 0-2000 ppm	**O_2** 0-30 % Vol.	**Combustible** 0-100% LEL 0-5.00% CH_4
	SO_2 0-20 ppm	**NO_2** 0-20 ppm	**NH_3** 0-100 ppm	**PH_3** 0-5 ppm
	Cl_2 0-10 ppm	**ClO_2** 0-1 ppm	**HCN** 0-100 ppm	**NO** 0-250 ppm

5.2 Factory-set Alarm Thresholds

SENSOR	LOW ALARM	HIGH ALARM	SETPOINT MIN	SETPOINT MAX	STEL	TWA
COMB	10% LEL	20% LEL	5% LEL	60% LEL	--[1]	--[1]
CO	25 ppm	100 ppm	10 ppm	1700 ppm	100 ppm	25 ppm
H_2S	10 ppm	15 ppm	5 ppm	175 ppm	15 ppm	10 ppm
O_2	19.5%	23.0%	5.0%	24.0%	--[1]	--[1]
SO_2	2.0 ppm	5.0 ppm	2.0 ppm	17.5 ppm	5 ppm	2.0 ppm
NO	25	100	10	200	25	25
NO_2	2.0 ppm	5.0 ppm	1.0 ppm	17.5 ppm	5.0 ppm	2.0 ppm
NH_3	25 ppm	50 ppm	10 ppm	75 ppm	35 ppm	25 ppm
PH_3	0.3 ppm	1.0 ppm	0.3 ppm	3.75 ppm	1.0 ppm	0.3 ppm
Cl_2	0.5 ppm	1.0 ppm	0.3 ppm	7.5 ppm	1.0 ppm	0.5 ppm
ClO_2	0.1 ppm	0.3 ppm	0.1 ppm	0.9 ppm	0.3 ppm	0.1 ppm
HCN	4.5 ppm	10.0 ppm	2.0 ppm	20.0 ppm	10 ppm	4.5 ppm
IR - CO_2 (10% Vol)	0.5% Vol	1.5% Vol	0.2% Vol	8% Vol	0.5% Vol	1.5% Vol
IR Propane (100% Vol)	--[2]	--[2]	--[2]	--[2]	--[1]	--[1]
IR Butane (25% Vol)	8% Vol	15% Vol	5% Vol	25% Vol	--[1]	--[1]
IR Methane (100% Vol)	--[2]	--[2]	--[2]	--[2]	--[1]	--[1]

[1]STEL and TWA not applicable for combustible and oxygen gases.

[2]No alarm thresholds are possible for the 0-100% Vol Methane and Propane IR sensors. In environments with >100% LEL combustible gas present, units with a catalytic combustible LEL sensor will be in a latching over-range alarm, and the 100% Vol IR sensors will display the % Vol gas reading.

5.3 Sensor Performance Specifications

PRIMARY SENSORS

	RANGE	RESOLUTION	REPRODUCIBILITY	RESPONSE TIME
Combustible (LEL)	0-100% LEL or 0-5% CH_4	1% LEL or 0.05% Vol CH_4	Normal temp. range: <50% LEL: 3% LEL 50-100% LEL: 5% LEL <2.5% CH_4: 0.15% CH_4 2.5-5.00% CH_4: 0.25% CH_4 Extended temp. range: <50% LEL: 5% LEL 50-100% LEL: 8% LEL <2.5% CH_4: 0.25% CH_4 2.5-5.00% CH_4: 0.40% CH_4	t(90) <15 sec (Pentane) (normal temp.) t(90) <10 sec (Methane) (normal temp.)
Oxygen	0-30% O_2	0.1% O_2	0.7% O_2 for 0 - 30% O_2	t(90) <10 sec (normal temp.)
Carbon Monoxide	0-2000 ppm CO	1 ppm CO,	Normal temp. range: ±5 ppm or 10% of reading, whichever is greater; Extended temp. range: ±10 ppm or 20% of reading, whichever is greater	t(90) <15 sec (normal temp.)
Hydrogen Sulfide	0-200 ppm H_2S	1 ppm H_2S, 3-200 ppm H_2S	Normal temp. range: ±2 ppm H_2S or 10 % of reading, whichever is greater; Extended temp. range: ±20 ppm or 20% of reading, whichever is greater	t(90) <15 sec (normal temp.)

IR SENSORS

	RANGE	RESOLUTION	REPRO-DUCIBILITY OF THE ZERO	REPRO-DUCIBILITY OF THE MSD. VALUE	RESPONSE TIME AT 20°C T90
Carbon Dioxide	0 - 10% Vol	0.01% Vol	≤ ± 0.1 % Vol	≤ ±4%	≤35
Methane	0 - 100% Vol	1% Vol	≤ ± 5 % Vol	≤ ±10%	≤34
Propane	0 - 100% Vol	1% Vol	≤ ± 3 % Vol	≤ ±8%	≤36
Butane	0 - 25 % Vol	0.1% Vol	≤ ± 0.5 % Vol	≤ ±4%	≤35

ADDITIONAL TOXIC SENSORS

	RANGE (PPM)	RESOLU-TION (PPM)	REPRODUCABILITY NORMAL TEMP. RANGE	REPRODUCABILITY EXTENDED TEMP. RANGE	NOMINAL RESPONSE TIME *
Cl_2 Chlorine	0-10	0.05	±0.2 ppm or 10% of reading (whichever is greater)	±0.5 ppm or 20% of reading (whichever is greater)	t(90) < 30 secs
NH_3 Amonia	0-100	1	±2 ppm or 10% of reading (whichever is greater)	±5 ppm or 20% of reading (whichever is greater)	t(90) < 40 secs
HCN Hydrogen Cyanide	0-30	0.5	±1 ppm or 10% of reading (whichever is greater)	±2 ppm or 20% of reading (whichever is greater)	t(90) < 30 secs
SO_2 Sulphur Dioxide	0-20	0.1	±2 ppm or 10% of reading (whichever is greater)	±3 ppm or 20% of reading (whichever is greater)	t(90) < 20 secs
ClO_2 Chlorine Dioxide	0-1	0.01	±0.1 ppm or 10% of reading (whichever is greater)	±0.2 ppm or 20% of reading (whichever is greater)	t(90) < 2 mins
NO Nitric Oxide	0-100	1			
NO_2 Nitrogen Dioxide	0-20	0.1	±2 ppm or 10% of reading (whichever is greater)	±3 ppm or 20% of reading (whichever is greater)	t(90) < 40 secs
PH_3 Phosphine	0 - 5	0.05	±2 ppm or 10% of reading (whichever is greater)	±0.25 ppm or 20% of reading (whichever is greater)	t(90) < 30 secs

* Response time is for normal temperature range with sensor in position #3.

5.4 Calibration Specifications

See Section 6.1 for MSA gas cylinder part numbers.

SENSOR	ZERO GAS	ZERO CAL VALUE ***	SPAN CAL GAS	SPAN CAL VALUE	SPAN CAL TIME (minutes)
COMB PENTANE	FRESH AIR	0	1.45% METHANE	58 LEL	1
COMB METHANE (0-5% V)	FRESH AIR	0	2.5% METHANE	2.5%	1
COMB METHANE (4.4% V)	FRESH AIR	0	1.45% METHANE	33 LEL	1
*COMB PROPANE (1.7% V)	FRESH AIR	0	1.45% METHANE	58 LEL	1
*COMB PROPANE (2.1% V)	FRESH AIR	0	1.45% METHANE	46 LEL	1
*COMB BUTANE (1.4% V)	FRESH AIR	0	1.45% METHANE	58 LEL	1
*COMB METHANE (5.0% V)	FRESH AIR	0	1.45% METHANE	29 LEL	1
COMB HYDROGEN	FRESH AIR	0	1.45% METHANE	29 LEL	1
O_2	FRESH AIR	20.8%	15% O_2	15.0%	1
CO	FRESH AIR	0	60 PPM CO	60 PPM	1
H_2S	FRESH AIR	0	20 PPM H_2S	20 PPM	1
SO_2	FRESH AIR	0	10 PPM SO_2	10 PPM	1
Cl_2	FRESH AIR	0	10 PPM Cl_2	10 PPM	2
NO	FRESH AIR	0	50 PPM NO	50 PPM	4
NO_2	FRESH AIR	0	10 PPM NO_2	10 PPM	4
NH_3	FRESH AIR	0	25 PPM NH_3	25 PPM	2
PH_3	FRESH AIR	0	0.5 PPM PH_3	0.5 PPM	1
HCN	FRESH AIR	0	10 PPM HCN	10 PPM	4
**ClO_2	FRESH AIR	0	2 PPM Cl_2	0.8 PPM	6
IR CO_2 (10% V)	FRESH AIR	0.03%	2.5% CO_2	2.50%	2
IR BUTANE (25% V)	FRESH AIR	0	8% BUTANE	8%	2
IR PROPANE (100% V)	FRESH AIR	0	50% PROPANE	50%	2
IR METHANE (100% V)	FRESH AIR	0	50% METHANE	50%	2

Span values can be changed if using different gas cylinders than those listed. Changes can be made using MSA Link software.

*See Section 5.6.
**For most accurate results, calibration with ClO_2 is recommended.
***Zero cal time is one minute if a catalytic combustible or an IR sensor is installed - 30 seconds if not.

5.5 Certifications

See instrument label for the certifications that apply to your specific unit.

USA / NRTL (Intrinsic Safety, Non-Mining)	UL913 for Class I, Div. 1, Groups A, B, C and D, Class II, Div. 1, -40°C to +50°C, T4 (See instrument label for additional certification marks.)
Canada / CSA (Intrinsic Safety, Combustible Performance, Non-Mining)	CSA C22.2 No. 157 for Class I, Div. 1, Groups A, B, C and D CSA C22.2 No. 152 M1984 Combustible Performance Tamb = -40°C to +50°C, T4 for Intrinsic Safety Tamb = -20°C to +50°C, T4 for Combustible Performance
European Union / ATEX - FTZU (Intrinsic Safety, Industrial and Mining)	ALTAIR5X (with XCell™ Ex sensor not installed) ATEX I M1 Ex ia I Ma ATEX II 1G Ex ia IIC T3/T4 Ga, Tamb = -40°C to +50°C ALTAIR5X (with XCell™ Ex sensor installed) ATEX I M1 Ex ia I Ma ATEX II 2G Ex d ia mb IIC T3/T4 Gb, Tamb = -40°C to +50°C ALTAIR5XiR ATEX I M2 Ex ia e I Mb ATEX II 2G Ex ia d e mb IIC T4 Gb, Tamb = -40°C to +50°C EN60079-0, EN60079-1, EN60079-7, EN60079-11, EN60079-18, EN60079-26, EN50271 CE 0080
IECEx (Intrinsic Safety, Industrial and Mining - TestSafe)	ALTAIR5X (with XCell™ Ex sensor not installed) Ex ia I IP65 Ex ia IIC T4 IP65, Tamb = -40°C to +50°C ALTAIR5X (with XCell™ Ex sensor installed) Ex d ia I IP65 Ex d ia IIC T4 IP65, Tamb = -40°C to +50°C ALTAIR5XiR Ex d ia I IP65 Ex d ia IIC T4 IP65, Tamb = -40°C to +50°C IEC60079-0, IEC60079-1, IEC60079-7, IEC60079-11, IEC60079-18, IEC60079-26
Australia (Intrinsic Safety, Industrial and Mining - TestSafe)	ALTAIR5X / ALTAIR5XiR Ex ia s Zone 0 I IP65 Ex ia s Zone 0 IIC T4 IP65, Tamb = -40°C to +50°C IEC60079-0, IEC60079-1, IEC60079-11, AS-1826

5.6 Combustible Gas Cross Reference Factors

5.7 XCell Sensor Patents

SENSOR	PART NO.	PATENT STATUS
Combustible	10106722	Patent Pending
Oxygen	10106729	Patent Pending
Carbon Monoxide / Hydrogen Sulfide	10106725	Patent Pending
Ammonia	10106726	Patent Pending
Chlorine	10106728	Patent Pending
Sulphur Dioxide	10106727	Patent Pending

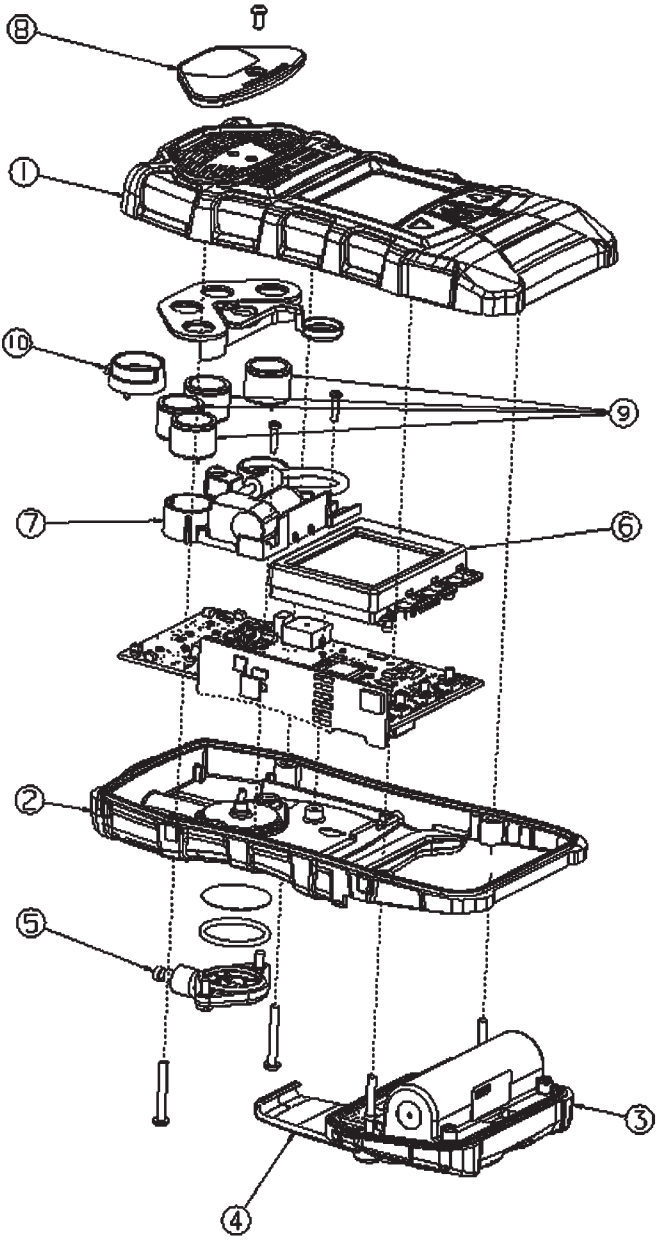
6. Order Information
6.1 Gas Cylinder Parts List

# GASES	GAS MIX	MSA P/N ECONO-CAL (34 L)	MSA P/N RP (58 L)	RECOMMENDED CAL GAS FOR:
1	10% CO_2 in N_2		10081603	
1	8% Butane in N_2 (6L)	10075802		25% Vol Butane IR
1	50% Vol Methane in N_2 (103L)		10075804	100% Vol Methane IR
1	50% Vol Propane N_2	10029475		100% Vol Propane IR
1	100% Vol Methane		711014	
1	10 ppm NO_2 in Air	711068	808977	NO_2 sensor
1	10 ppm SO_2 in Air	711070	808978	SO_2 sensor
1	25 ppm NH_3 in N_2	711078	814866	NH_3 sensor
1	10 ppm Cl_2 in N_2	711066	806740	Cl_2 sensor
1	2 ppm Cl_2 in N_2	711082	10028080	ClO_2 sensor
1	10 ppm HCN in N_2	711072	809351	HCN sensor
1	0.5 ppm PH_3 in N_2	711088	710533	PH_3 sensor
3	1.45% CH_4, 15.0% O_2, 20 ppm H_2S	10048790	10048788	
3	2.50% CH_4, 15.0% O_2, 20 ppm H_2S	10048888	10048889	
3	1.45% CH_4, 15.0% O_2, 60 ppm CO	10048789	478191	
3	2.50% CH_4, 15.0% O_2, 60 ppm CO	10049056	813718	
4	1.45% CH_4, 15.0% O_2, 60 ppm CO, 10 ppm NO_2		10058034	
4	1.45% CH_4, 15.0% O_2, 60 ppm CO, 20 ppm H_2S	10048280	10045035	
4	2.50% CH_4, 15.0% O_2, 60 ppm CO, 20 ppm H_2S	10048981	10048890	
4	1.45% CH_4, 15.0% O_2, 60 ppm CO, 10 ppm NO_2	10058036	10058171	
4	2.50% CH_4, 15.0% O_2, 60 ppm CO, 10 ppm NO_2	10058172		
5	1.45% CH_4, 15.0% O_2, 60 ppm CO, 20 ppm H_2S, 2.5% CO_2		10103262	10% CO_2 IR
5	1.45% CH_4, 15.0% O_2, 60 ppm CO, 20 ppm H_2S, 10 PPM SO_2	10098855	10117738	SO_2 sensor

6.2 Accessories Parts List

DESCRIPTION	PART NO.
CALIBRATION ACCESSORIES	
Demand Regulator Kit	710288
$Cl_2/NH_3/ClO_2$ Demand Regulator Kit	10034391
INTERFACE & CARRYING ACCESSORIES	
MSA Link USB dongle	10082834
MSA Link Datalogging Software	10088099
Shoulder Strap	474555
Retractable Line with Belt Clip	10050976
Holster, leather	10099648
CHARGING ACCESSORIES	
Charger only (North America)	10087913
Charger only (Global version)	10092936
Charging Cradle with Barrier- (North America)	10093055
Charging Cradle - (North America)	10093054
Charging Cradle (Europe)	10093057
Charging Cradle (Australia)	10093056
Vehicle Charger Cradle	10099397
Cradle Only - (no charger)	10093053
Multi-Unit Charger, ALTAIR 5X Five-Unit (North American)	10111213
Multi-Unit Charger, ALTAIR 5X 10-Unit (North American)	10111215
SAMPLE LINES & PROBES	
Probe, 1 ft. straight PEEK	10042621
Probe, 3 ft. straight PEEK	10042622
Polyurethane Sample Line, 10 ft.	10040665
Polyurethane Sample Line, 25 ft.	10040664
Polyurethane Sample Line, 3 ft. Coiled	10040667
(Cl_2, ClO_2, NH_3) 5 ft.PU Coiled Sample line & probe, kit	10105210
(Cl_2, ClO_2, NH_3) 5 ft. PU Sample line & probe, kit	10105251
(Cl_2, ClO_2, NH_3) 10 ft. Teflon Sample line & probe, kit	10105839
Replacement Filters for probe, 10 pack	801582

6.3 Instrument Replacement Parts



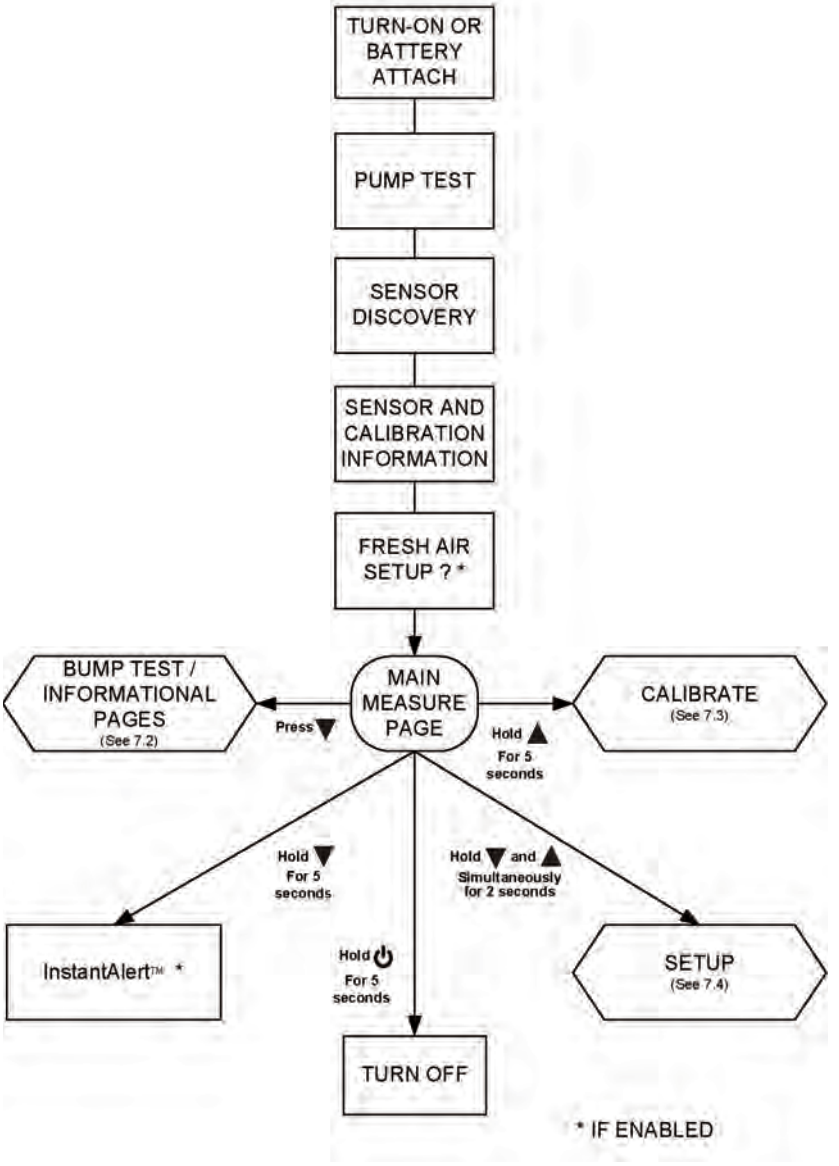
NO.	DESCRIPTION	PART NO.
1	Case assembly, upper, with label	10114853
	Case assembly, upper, (phosphorescent), with label	10114854
2	Case, lower, ALTAIR 5X	10114809
	Case, lower, ALTAIR 5X IR	10114810
	Case, lower, ALTAIR 5X IR, (phosphorescent)	10114811
3	Battery pack, rechargeable, North America, ALTAIR 5X	10114835
	Battery pack, rechargeable, European/Australian, ALTAIR 5X	10114836
	Battery pack, alkaline, North America, ALTAIR 5X	10114837
	Battery pack, alkaline, European/Australian, ALTAIR 5X	10114838
	Battery pack, rechargeable, North America, ALTAIR 5X IR	10114839
	Battery pack, rechargeable, European/Australian, ALTAIR 5X IR	10114851
	Battery Pack, rechargeable, North American ALTAIR 5X IR (phosphorescent)	10114840
	Battery Pack, rechargeable, European/Australian ALTAIR 5X IR (phosphorescent)	10114852
4	Kit, belt clip replacement, (ALTAIR 5X rechargeable)	10094830
	Kit, maintenance (includes filters, o-ring, screws)	10114949
	Kit, maintenance, reactive gas (Cl_2, ClO_2, NH_3) (includes filters, o-ring, screws)	10114950
5	Filter cover assembly	10083591
6	Display assembly, monochrome	10111389
	Display assembly, color	10099650
7	Sensor bracket assembly with pump, ALTAIR 5X (includes vibrator motor)	10114804
	Sensor bracket assembly with pump, ALTAIR 5X IR (includes vibrator motor)	10114805
8	Kit, pump cap replacement	10114855
9	Sensor, HCN (Series 20)	10106375
	XCell Sensor, Cl_2	10106728
	Sensor, ClO_2 (Series 20)	10080222
	XCell Sensor, SO_2	10106727
	Sensor, NO_2 (Series 20)	10080224
	XCell Sensor, NH_3	10106726
	Sensor, PH_3 (Series 20)	10116638
	XCell Sensor, COMB	10106722
	XCell Sensor, O_2	10106729
	XCell Sensor, CO-H_2S, Two-Tox	10106725
	Sensor, NO (Series 20)	10114750

	DESCRIPTION	PART NO.
	XCell Sensor, CO	10106724
	XCell Sensor, H_2S	10106723
	XCell Sensor plug	10105650
	20 mm Sensor plug	10088192
10	XCell adapter socket	10110183

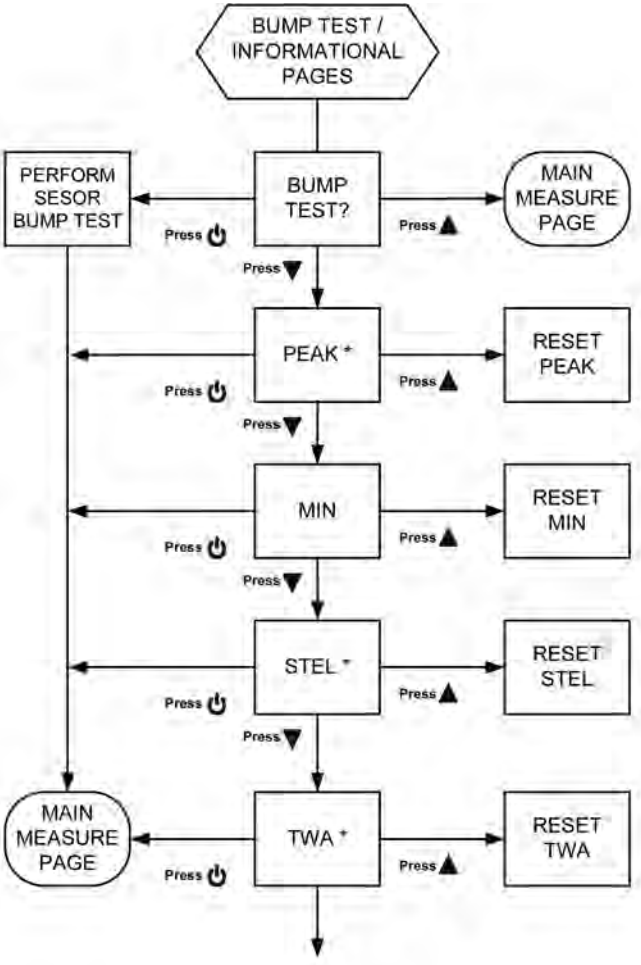
	DESCRIPTION		PART NO.
IR sensors – must be repaired or replaced at a Certified Service Center			
	CO_2	0 - 10% Vol	10062209
	CH_4	0 - 100% Vol (Methane)	10062205
	C_3H_8	0 - 100% Vol (Propane)	10062207
	C_4H_{10}	0 - 25 % Vol (Butane)	10062201

7 Flow Charts

7.1 Basic Operation

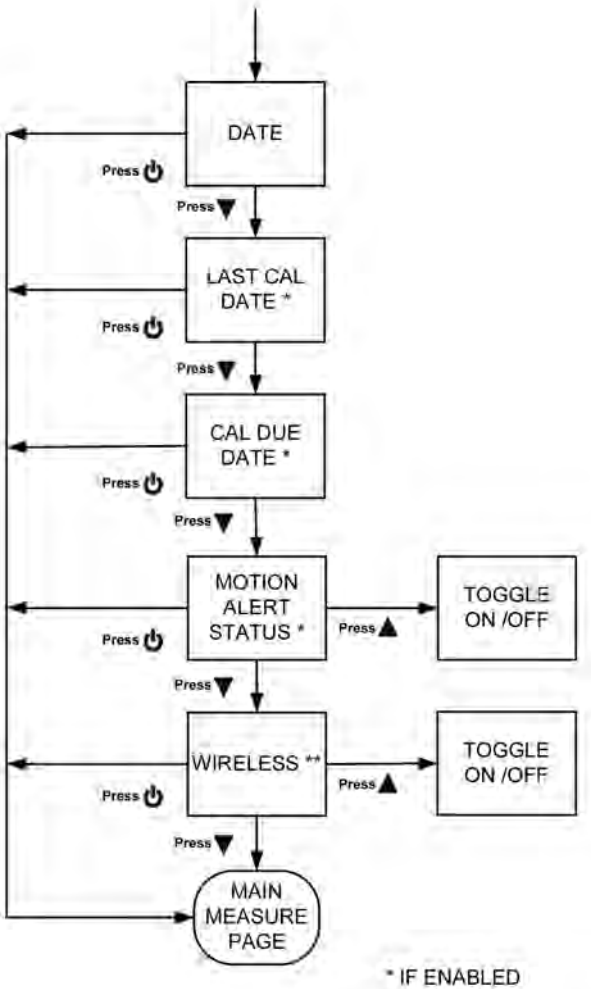


7.2 BUMP TEST / Informational Pages

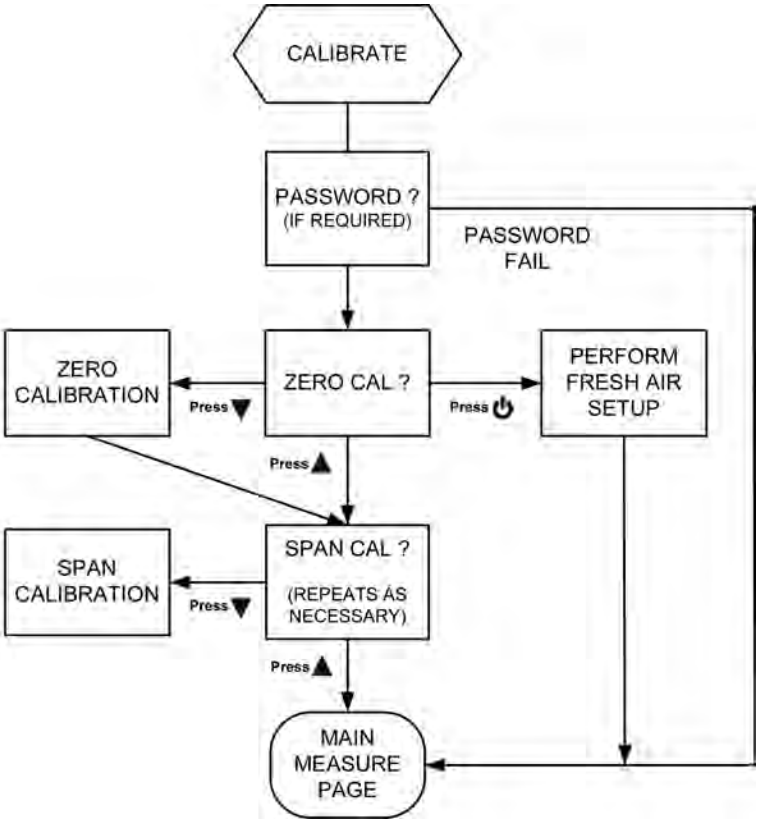


* IF ENABLED (NOT VALID FOR ALL SENSORS)

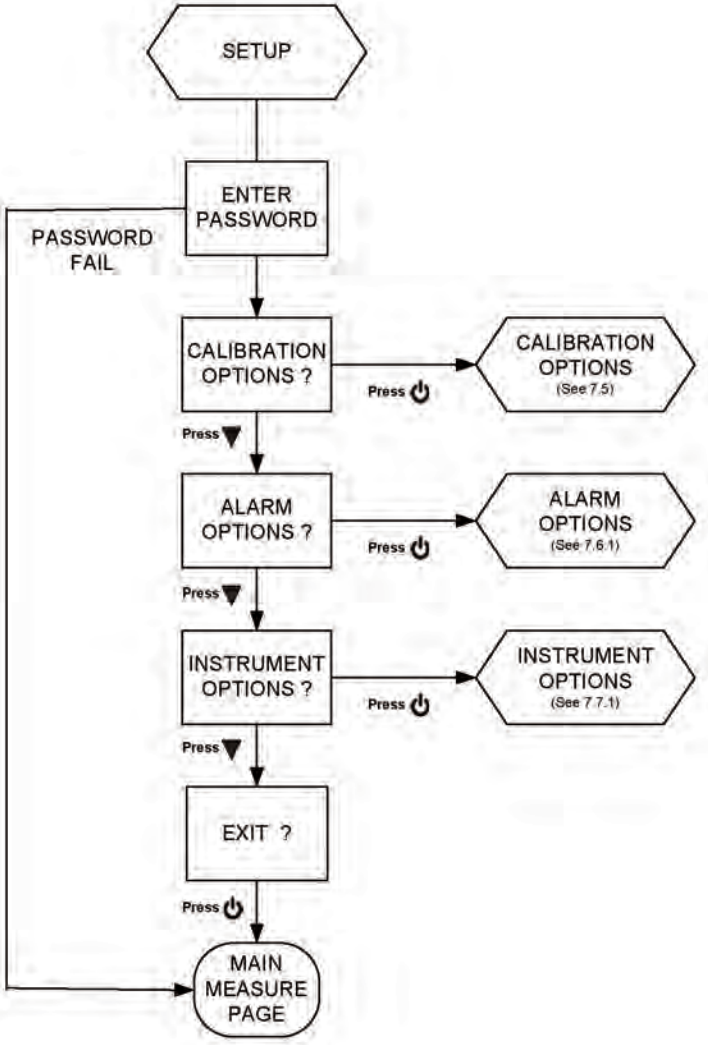
7.2 (Continued)



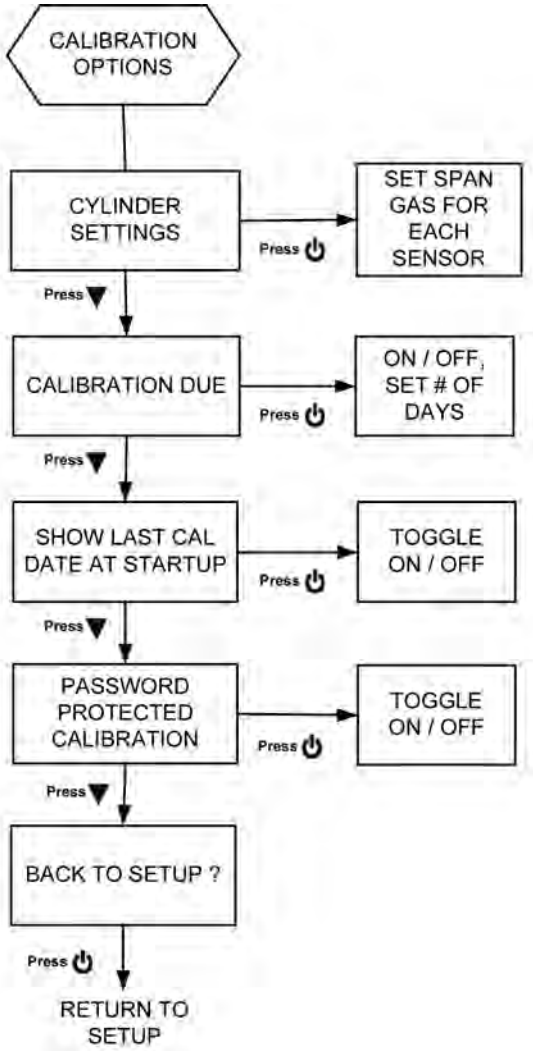
7.3 Calibrate



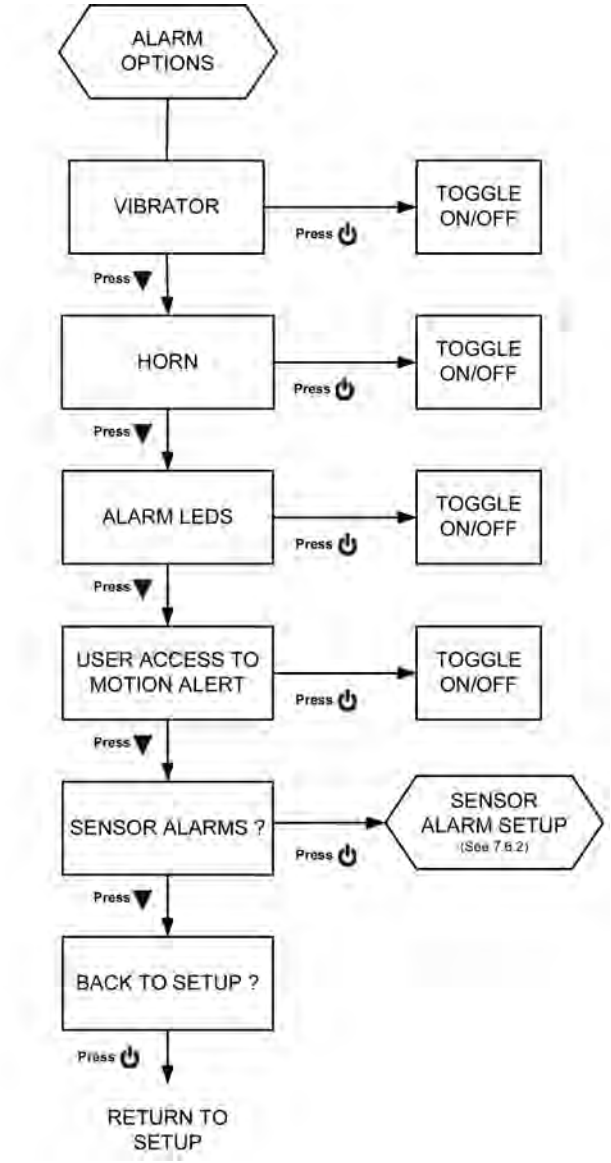
7.4 Setup


SETUP
ENTER PASSWORD
PASSWORD FAIL
CALIBRATION OPTIONS ?
Press
CALIBRATION OPTIONS
(See 7.5)
Press
ALARM OPTIONS ?
Press
ALARM OPTIONS
(See 7.6.1)
Press
INSTRUMENT OPTIONS ?
Press
INSTRUMENT OPTIONS
(See 7.7.1)
Press
EXIT ?
Press
MAIN MEASURE PAGE

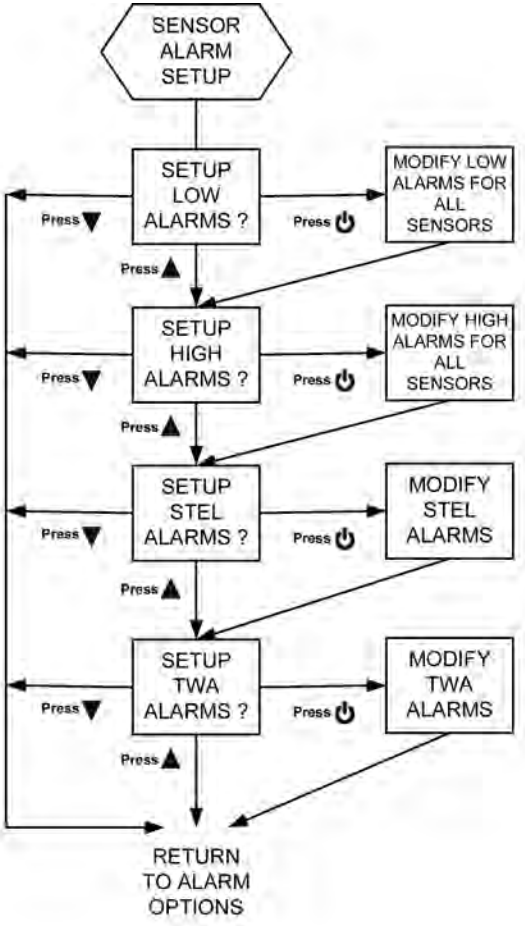
7.5 Calibration Options



7.6.1 Alarm Options

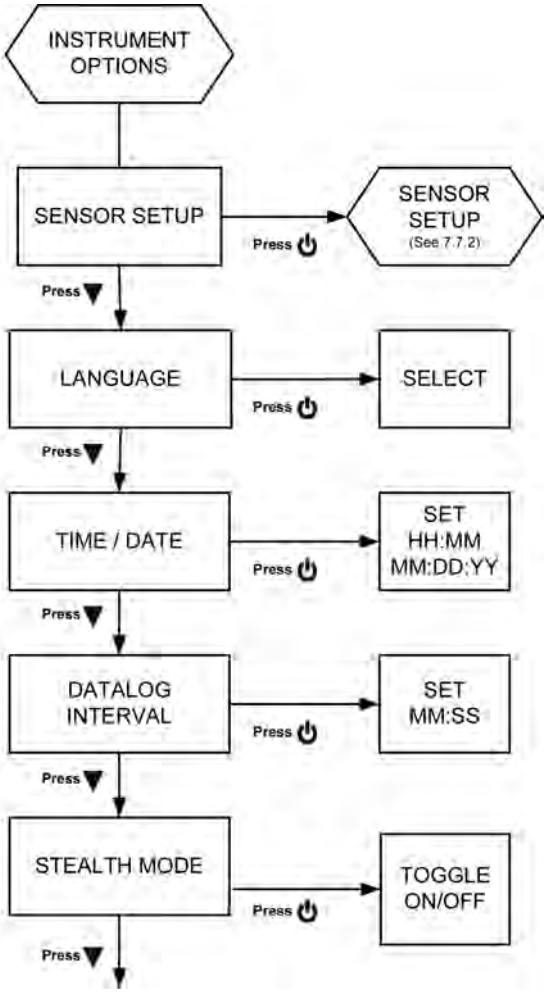


7.6.2 Sensor Alarm Setup

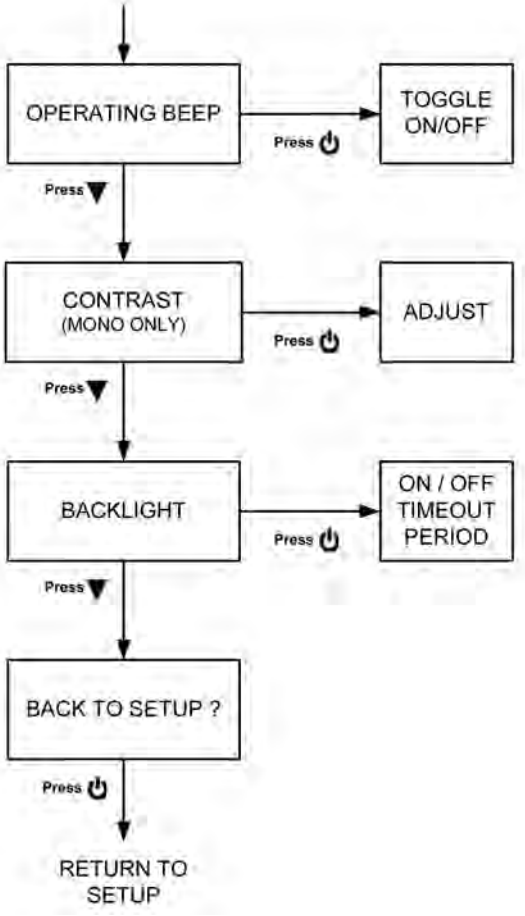


NOTE: STEL AND TWA ARE NOT VALID FOR ALL SENSORS

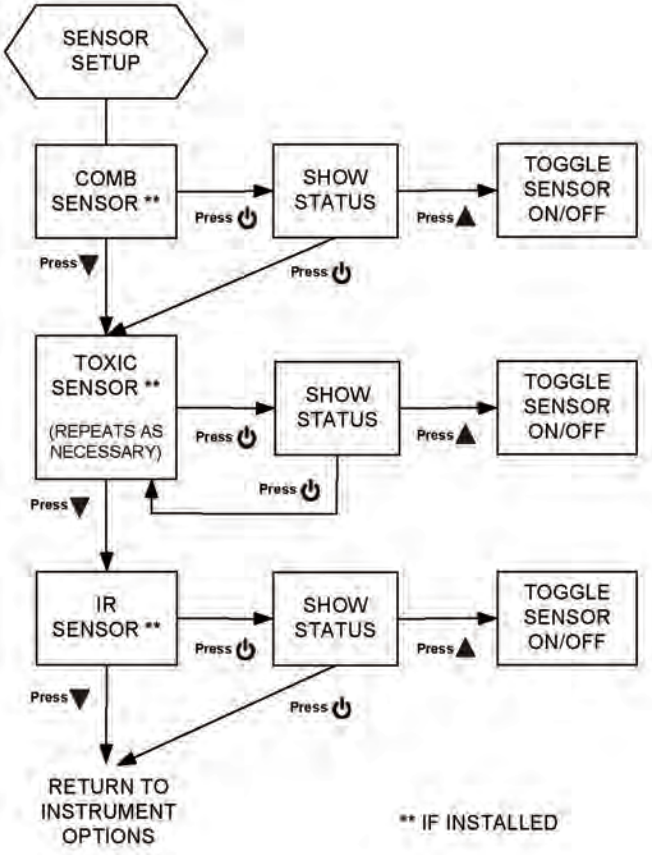
7.7.1 Instrument Options



7.7.1 (Continued)



7.7.2 Sensor Setup



8. Changeable Feature Summary

FEATURE	INITIAL SETTING	INSTRUMENT SETUP PATH TO CHANGE THIS SETTING	SEE SECTIONS:	MSA Link CHANGE-ABLE ?
Setup Password	672	No	3.4	Yes
Vibrating Alarm	ON	ALARM OPTIONS	2.2.3.1, 3.4.2	Yes
Horn Alarm	ON	ALARM OPTIONS	2.2.3.2, 3.4.2	Yes
LED Alarm	ON	ALARM OPTIONS	2.2.2.2, 3.4.2	Yes
Safe LED (green)	ON	No	2.2.2.2	Yes
Operating Beep (alarm LEDs & horn)	OFF	INSTRUMENT OPTIONS	2.2.3.4, 3.4.3	Yes
Stealth	OFF	INSTRUMENT OPTIONS	2.2.3.5, 3.4.3	No
MotionAlert - Access	Allowed	ALARM OPTIONS	2.4.9, 3.4.2	No
MotionAlert	OFF	Use ▼ button from MEASURE page	2.2.3.4	No
Sensor Alarm Levels	(see Sec. 5.4)	ALARM OPTIONS / SENSOR ALARM SETUP	2.6, 2.7, 2.8, 3.4.2	Yes
Enable / Disable High & Low Alarms	Enabled	No	2.6, 2.7, 2.9	Yes
Turn Sensors ON / OFF	ON	INSTRUMENT OPTIONS / SENSOR SETUP	2.6, 2.7, 2.10 3.4.3	Yes
Show Peak	ON	No	2.4.2	Yes
Show STEL, TWA	ON	No	2.4.4, 2.4.5	Yes
Cal Cylinder Setup	(Sec. 5.2)	CAL OPTIONS	3.4.1	Yes
Show Last Cal Date	ON	CAL OPTIONS	2.4.7 3.4.1	Yes
Show Cal Due	ON	CAL OPTIONS	2.4.8 3.4.1	No
Cal Password Required	Not req'd.	CAL OPTIONS	3.4.1	No
Backlight	Enabled		2.2.4, 3.4.3	No
Backlight Duration	10 Secs	INSTRUMENT OPTIONS	2.2.4, 3.4.3	Yes
Display Contrast	Factory-set	INSTRUMENT OPTIONS	2.2.4, 3.4.3	No
Language	User-set	INSTRUMENT OPTIONS	3.4.3	No
Date, Time	User-set	INSTRUMENT OPTIONS	3.4.3	Yes
Datalog Interval	3 min	INSTRUMENT OPTIONS	3.4.3	Yes
Custom Logo Screen	Factory-set	Certified service center		No
Instrument S/N	Factory-set	No	3.2	Yes
Company Name	Blank	No	3.2	Yes
Dept./User Name	Blank	No	3.2	Yes